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(30)Priority

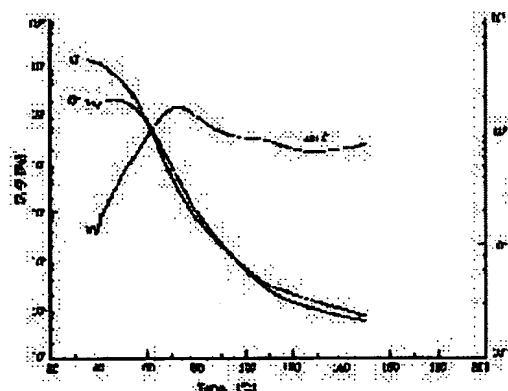
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## (54) TONER FOR DEVELOPING ELECTROSTATIC CHARGE IMAGE AND IMAGE FORMING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a toner for developing an electrostatic charge image having satisfactory low-temp. fixability, anti-offsetting property and blocking resistance independently of transfer paper.

SOLUTION: This toner contains a binder resin, a colorant and wax. A temp. at which the ratio ( $G''/G'=\tan \delta$ ) of the modulus of lost elasticity of this toner to the modulus of storage elasticity becomes 1.0 exists in the range of 55-70° C, and at the temp. the modulus of elasticity is  $\leq 1.5 \times 10^8$  Pa. The ratio ( $G'_{40}/G'_{50}$ ) of the modulus ( $G'_{40}$ ) of storage elasticity of this toner at 40° C to the modulus ( $G'_{50}$ ) of storage elasticity at 50° C is 1.5-5.0, the ratio ( $G'_{50}/G'_{60}$ ) of the modulus ( $G'_{50}$ ) of storage elasticity at 50° C to the modulus ( $G'_{60}$ ) of storage elasticity at 60° C is 3-20, the ratio ( $G'_{70}/G'_{100}$ ) of the modulus ( $G'_{70}$ ) of storage elasticity at 70° C to the modulus ( $G'_{100}$ ) of storage elasticity at 100° C is 50-250 and the ratio ( $G'_{110}/G'_{140}$ ) of the modulus ( $G'_{110}$ ) of storage elasticity at 110° C to the modulus ( $G'_{140}$ ) of storage elasticity at 140° C is 2-20.



## LEGAL STATUS

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[Date of registration]

[Number of appeal against examiner's decision of rejection] 2003-06945

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**CLAIMS**


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**[Claim(s)]**

[Claim 1] In a toner for electrostatic-charge image development containing binding resin, a coloring agent, and a wax this toner (a) It exists in a temperature field whose temperature from which a ratio ( $G''/G'=\tan\delta$ ) of a loss modulus and a storage modulus is set to 1.0 is 55–70 degrees C. And an elastic modulus at that time is below  $1.5 \times 10^8$  Pa, and ratios ( $G'40/G'50$ ) of a storage modulus ( $G'40$ ) in (b) temperature of 40 degrees C and a storage modulus ( $G'50$ ) in temperature of 50 degrees C are 1.5–5.0. (c) Ratios ( $G'50/G'60$ ) of a storage modulus ( $G'50$ ) and a storage modulus ( $G'60$ ) in temperature of 60 degrees C are 3–20. (d) Ratios ( $G'70/G'100$ ) of a storage modulus ( $G'70$ ) in temperature of 70 degrees C and a storage modulus ( $G'100$ ) in temperature of 100 degrees C are 50–250. (e) A toner for electrostatic-charge image development characterized by ratios ( $G'110 / G'140$ ) of a storage modulus ( $G'110$ ) in temperature of 110 degrees C and a storage modulus ( $G'140$ ) in temperature of 140 degrees C being 2–20.

[Claim 2] This toner is a toner for electrostatic-charge image development according to claim 1 which exists in a temperature field whose temperature from which a ratio ( $G''/G'$ ) is set to 1.0 is 58–68 degrees C, and is characterized by an elastic modulus at that time being  $1 \times 10^7$  Pa –  $1.3 \times 10^8$  Pa.

[Claim 3] This toner is a toner for electrostatic-charge image development according to claim 1 which exists in a temperature field whose temperature from which a ratio ( $G''/G'$ ) is set to 1.0 is 59–65 degrees C, and is characterized by an elastic modulus at that time being  $3 \times 10^7$  Pa –  $1.0 \times 10^8$  Pa.

[Claim 4] This toner is a toner for electrostatic-charge image development according to claim 1 to 3 characterized by ratios ( $G'40/G'50$ ) of this storage modulus ( $G'40$ ) and this storage modulus ( $G'50$ ) being 1.8–4.0.

[Claim 5] This toner is a toner for electrostatic-charge image development according to claim 1 to 3 characterized by ratios ( $G'40/G'50$ ) of this storage modulus ( $G'40$ ) and this storage modulus ( $G'50$ ) being 2.0–3.5.

[Claim 6] This toner is a toner for electrostatic-charge image development according to claim 1 to 5 characterized by ratios ( $G'50/G'60$ ) of this storage modulus ( $G'50$ ) and this storage modulus ( $G'60$ ) being 4–15.

[Claim 7] This toner is a toner for electrostatic-charge image development according to claim 1 to 5 characterized by ratios ( $G'50/G'60$ ) of this storage modulus ( $G'50$ ) and this storage modulus ( $G'60$ ) being 5–10.

[Claim 8] This toner is a toner for electrostatic-charge image development according to claim 1 to 7 characterized by ratios ( $G'70/G'100$ ) of this storage modulus ( $G'70$ ) and this storage modulus ( $G'100$ ) being 60–240.

[Claim 9] This toner is a toner for electrostatic-charge image development according to claim 1 to 7 characterized by ratios ( $G'70/G'100$ ) of this storage modulus ( $G'70$ ) and this storage modulus ( $G'100$ ) being 70–220.

[Claim 10] This toner is a toner for electrostatic-charge image development according to claim 1 to 9 characterized by ratios ( $G'110 / G'140$ ) of this storage modulus ( $G'110$ ) and this storage

modulus (G'140) being 2.5–18.

[Claim 11] This toner is a toner for electrostatic-charge image development according to claim 1 to 9 characterized by ratios (G'110 / G'140) of this storage modulus (G'110) and this storage modulus (G'140) being 3–15.

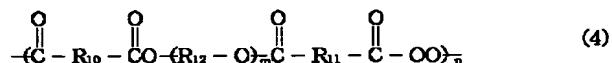
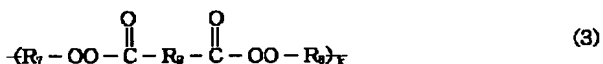
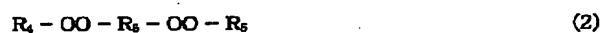
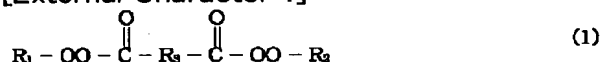
[Claim 12] This binding resin is a toner for electrostatic-charge image development according to claim 1 to 11 characterized by containing a block copolymer which has an aromatic series vinyl monomer unit and (meta) an acrylic ester monomer unit.

[Claim 13] This block copolymer is a toner for electrostatic-charge image development according to claim 1 to 12 characterized by containing to this binding resin 10% of the weight or more to all binding resin.

[Claim 14] This block copolymer is a toner for electrostatic-charge image development according to claim 1 to 13 characterized by changing 5 degrees C or more of polymerization reaction temperature, and being compounded by radical polymerization using a radical polymerization initiator whose difference of 10-hour reduction-by-half temperature from which it has an aromatic series vinyl monomer and (meta) two or more acrylic ester monomers in intramolecular, and a cleavage reaction of each peroxide radical occurs a peroxide radical in them is 5 degrees C or more.

[Claim 15] binding resin — an aromatic series vinyl monomer and (meta) an acrylic ester monomer — the following chemical formula (1), (2), and (3) — or (4) —

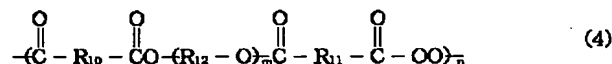
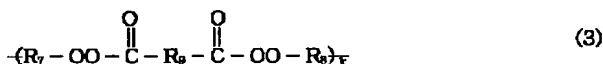
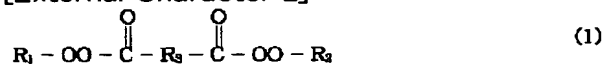
[External Character 1]



R1, R2, R3, R4, R5, R6, R7, R8, R9, and R10, R11 and R12 show the straight chain of carbon numbers 2–30, branching, an annular alkyl group, or the aryl group of carbon numbers 6–20 among [type, and even if these are the same, they may differ mutually. k and n express the integer of 2–50, and m expresses the integer of 1–20. ] The toner for electrostatic-charge image development according to claim 1 to 14 characterized by containing the copolymer compounded by coming out, changing 5 degrees C or more of polymerization reaction temperature, and carrying out a radical polymerization using the radical polymerization initiator shown.

[Claim 16] this binding resin — (i) aromatic series vinyl monomer — (independent or monomer mixture which mixed an aromatic series vinyl monomer and an acrylic ester (meta) monomer by weight ratio 20:1–1:1, the following chemical formula (1) and (2), (3) — or (4) —

[External Character 2]



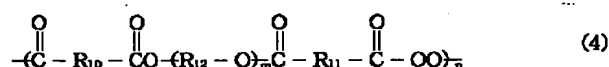
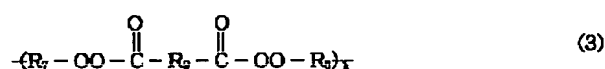
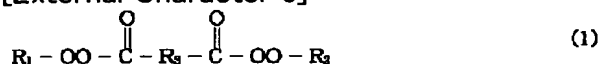
R1, R2, R3, R4, R5, R6, R7, R8, R9, and R10, R11 and R12 show the straight chain of carbon numbers 2–30, branching, an annular alkyl group, or the aryl group of carbon numbers 6–20 among [type, and even if these are the same, they may differ mutually. k and n express the integer of 2–50, and m expresses the integer of 1–20. ] 1st polymerization reaction production process which performs a polymerization reaction for the monomer constituent which comes out

and contains the radical polymerization initiator expressed at 50–120 degrees C;

(ii) (meta) The monomer mixture which mixed an acrylic ester monomer independent or the aromatic series vinyl monomer, and the acrylic ester (meta) monomer by the weight ratio 1:20–1:1 is added again. The toner for electrostatic-charge image development according to claim 1 to 14 characterized by containing the copolymer compounded through the production process which carries out a polymerization reaction at at least two steps of different temperature which have 2nd polymerization reaction production process; which performs a polymerization reaction with a temperature higher 5 degrees C or more than the 1st polymerization reaction.

[Claim 17] this binding resin — (i) (meta) acrylic ester monomer — (independent or monomer mixture which mixed an aromatic series vinyl monomer and an acrylic ester (meta) monomer by weight ratio 1:20–1:1, the following chemical formula (1) and (2), 3) — or (4) —

[External Character 3]



R1, R2, R3, R4, R5, R6, R7, R8, R9, and R10, R11 and R12 show the straight chain of carbon numbers 2–30, branching, an annular alkyl group, or the aryl group of carbon numbers 6–20 among [type, and even if these are the same, they may differ mutually. k and n express the integer of 2–50, and m expresses the integer of 1–20. ] Production process which carries out the polymerization reaction of the monomer constituent which comes out and contains the radical polymerization initiator expressed at 50–120 degrees C;

(ii) toner for electrostatic charge image development according to claim 1 to 14 characterize by contain the copolymer compounded through the production process which carry out a polymerization reaction at at least two steps of different temperature which consist of production process; which add again the monomer mixture which mixed an aromatic series vinyl monomer independent or the aromatic series vinyl monomer, and the acrylic ester (meta) monomer by the weight ratio 20:1–1:1, and carry out a polymerization reaction at the temperature of 55 degrees C or more.

[Claim 18] This binding resin is a toner for electrostatic-charge image development according to claim 1 to 17 characterized by having number average molecular weight (Mn) of 2,500–50,000, and weighted mean particle weight (Mw) of 10,000–1,500,000.

[Claim 19] This toner is a toner for electrostatic-charge image development according to claim 1 to 18 characterized by having a peak, respectively to a field of molecular weight 12,000–40,000, and a field of molecular weight 50,000–1,200,000 in molecular weight distribution by GPC of THF extractives of this toner.

[Claim 20] This toner is a toner for electrostatic-charge image development according to claim 1 to 19 characterized by a ratio of area (L) of a with a molecular weight of 45,000 or less low-molecular-weight field and area (H) of the amount field of macromolecules exceeding molecular weight 45,000 satisfying following (relation L):(H) =1:9–9.5–0.5 in molecular weight distribution by GPC of THF extractives of this toner.

[Claim 21] A development production process which develops with a toner an electrostatic latent image currently held at an electrostatic latent-image supporter, and forms a toner image, In an image formation method of having a fixing production process which carries out heating fixing of the toner image imprinted by an imprint production process and this record material which imprint this toner image to record material with a heating fixing means at this record material This toner contains binding resin, a coloring agent, and a wax. This toner (a) It exists in a temperature field whose temperature from which a ratio (G''/G'=tandelta) of a loss modulus and a storage modulus is set to 1.0 is 55–70 degrees C. And an elastic modulus at that time is

below  $1.5 \times 10^8$  Pa, and ratios ( $G'_{40}/G'_{50}$ ) of a storage modulus ( $G'_{40}$ ) in (b) temperature of 40 degrees C and a storage modulus ( $G'_{50}$ ) in temperature of 50 degrees C are 1.5–5.0. (c) A ratio ( $G'_{50}/G'_{60}$ ) of this storage modulus ( $G'_{50}$ ) and a storage modulus ( $G'_{60}$ ) in temperature of 60 degrees C is  $3-2 <DP N=0004> 0$ . (d) Ratios ( $G'_{70}/G'_{100}$ ) of a storage modulus ( $G'_{70}$ ) in temperature of 70 degrees C and a storage modulus ( $G'_{100}$ ) in temperature of 100 degrees C are 50–250. (e) An image formation method characterized by ratios ( $G'_{110} / G'_{140}$ ) of a storage modulus ( $G'_{110}$ ) in temperature of 110 degrees C and a storage modulus ( $G'_{140}$ ) in temperature of 140 degrees C being 2–20.

[Claim 22] This toner is the image formation method according to claim 21 which exists in a temperature field whose temperature from which a ratio ( $G''/G'$ ) is set to 1.0 is 58–68 degrees C, and is characterized by an elastic modulus at that time being  $1 \times 10^7$  Pa –  $1.3 \times 10^8$  Pa.

[Claim 23] This toner is the image formation method according to claim 21 which exists in a temperature field whose temperature from which a ratio ( $G''/G'$ ) is set to 1.0 is 59–65 degrees C, and is characterized by an elastic modulus at that time being  $3 \times 10^7$  Pa –  $1.0 \times 10^8$  Pa.

[Claim 24] This toner is the image formation method according to claim 21 to 23 characterized by ratios ( $G'_{40}/G'_{50}$ ) of this storage modulus ( $G'_{40}$ ) and this storage modulus ( $G'_{50}$ ) being 1.8–4.0.

[Claim 25] This toner is the image formation method according to claim 21 to 23 characterized by ratios ( $G'_{40}/G'_{50}$ ) of this storage modulus ( $G'_{40}$ ) and this storage modulus ( $G'_{50}$ ) being 2.0–3.5.

[Claim 26] This toner is the image formation method according to claim 21 to 25 characterized by ratios ( $G'_{50}/G'_{60}$ ) of this storage modulus ( $G'_{50}$ ) and this storage modulus ( $G'_{60}$ ) being 4–15.

[Claim 27] This toner is the image formation method according to claim 21 to 25 characterized by ratios ( $G'_{50}/G'_{60}$ ) of this storage modulus ( $G'_{50}$ ) and this storage modulus ( $G'_{60}$ ) being 5–10.

[Claim 28] This toner is the image formation method according to claim 21 to 27 characterized by ratios ( $G'_{70}/G'_{100}$ ) of this storage modulus ( $G'_{70}$ ) and this storage modulus ( $G'_{100}$ ) being 60–240.

[Claim 29] This toner is the image formation method according to claim 21 to 27 characterized by ratios ( $G'_{70}/G'_{100}$ ) of this storage modulus ( $G'_{70}$ ) and this storage modulus ( $G'_{100}$ ) being 70–220.

[Claim 30] This toner is the image formation method according to claim 21 to 29 characterized by ratios ( $G'_{110} / G'_{140}$ ) of this storage modulus ( $G'_{110}$ ) and this storage modulus ( $G'_{140}$ ) being 2.5–18.

[Claim 31] This toner is the image formation method according to claim 21 to 29 characterized by ratios ( $G'_{110} / G'_{140}$ ) of this storage modulus ( $G'_{110}$ ) and this storage modulus ( $G'_{140}$ ) being 3–15.

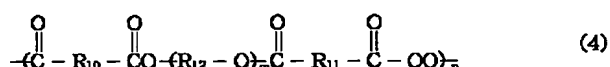
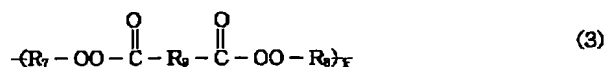
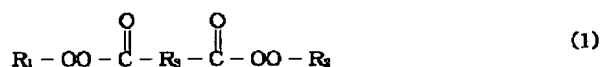
[Claim 32] This binding resin is the image formation method according to claim 21 to 31 characterized by containing a block copolymer which has an aromatic series vinyl monomer unit and (meta) an acrylic ester monomer unit.

[Claim 33] This block copolymer is the image formation method according to claim 21 to 32 characterized by containing to this binding resin 10% of the weight or more to all binding resin.

[Claim 34] This block copolymer is the image formation method according to claim 21 to 33 characterized by changing 5 degrees C or more of polymerization reaction temperature, and being compounded by radical polymerization using a radical polymerization initiator whose difference of 10-hour reduction-by-half temperature from which it has an aromatic series vinyl monomer and (meta) two or more acrylic ester monomers in intramolecular, and a cleavage reaction of each peroxide radical occurs a peroxide radical in them is 5 degrees C or more.

[Claim 35] binding resin — an aromatic series vinyl monomer and (meta) an acrylic ester monomer — the following chemical formula (1), (2), and (3) — or (4) —

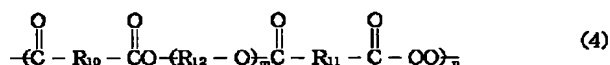
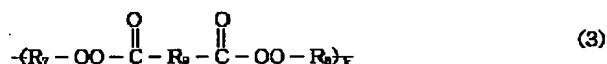
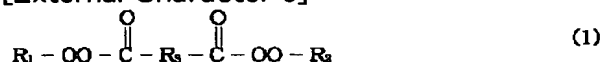
[External Character 4]



R1, R2, R3, R4, R5, R6, R7, R8, R9, and R10, R11 and R12 show the straight chain of carbon numbers 2–30, branching, an annular alkyl group, or the aryl group of carbon numbers 6–20 among [type, and even if these are the same, they may differ mutually. k and n express the integer of 2–50, and m expresses the integer of 1–20. ] The image formation method according to claim 21 to 34 characterized by containing the copolymer compounded by coming out, changing 5 degrees C or more of polymerization reaction temperature, and carrying out a radical polymerization using the radical polymerization initiator shown.

[Claim 36] this binding resin — (i) aromatic series vinyl monomer — (independent or monomer mixture which mixed an aromatic series vinyl monomer and an acrylic ester (meta) monomer by weight ratio 20:1–1:1, the following chemical formula (1) and (2), 3) — or (4) —

[External Character 5]

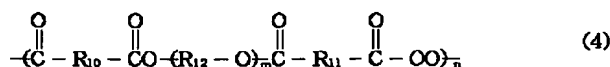
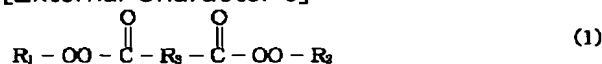


R1, R2, R3, R4, R5, R6, R7, R8, R9, and R10, R11 and R12 show the straight chain of carbon numbers 2–30, branching, an annular alkyl group, or the aryl group of carbon numbers 6–20 among [type, and even if these are the same, they may differ mutually. k and n express the integer of 2–50, and m expresses the integer of 1–20. ] 1st polymerization reaction production process which performs a polymerization reaction for the monomer constituent which comes out and contains the radical polymerization initiator expressed at 50–120 degrees C;

(ii) (meta) The monomer mixture which mixed an acrylic ester monomer independent or the aromatic series vinyl monomer, and the acrylic ester (meta) monomer by the weight ratio 1:20–1:1 is added again. The image formation method according to claim 21 to 34 characterized by containing the copolymer compounded through the production process which carries out a polymerization reaction at at least two steps of different temperature which have 2nd polymerization reaction production process; which performs a polymerization reaction with a temperature higher 5 degrees C or more than the 1st polymerization reaction.

[Claim 37] this binding resin — (i) (meta) acrylic ester monomer — (independent or monomer mixture which mixed an aromatic series vinyl monomer and an acrylic ester (meta) monomer by weight ratio 1:20–1:1, the following chemical formula (1) and (2), 3) — or (4) —

[External Character 6]



R1, R2, R3, R4, R5, R6, R7, R8, R9, and R10, R11 and R12 show the straight chain of carbon numbers 2–30, branching, an annular alkyl group, or the aryl group of carbon numbers 6–20 among [type, and even if these are the same, they may differ mutually. k and n express the integer of 2–50, and m expresses the integer of 1–20. ] Production process which carries out the polymerization reaction of the monomer constituent which comes out and contains the radical polymerization initiator expressed at 50–120 degrees C;

(ii) The image formation method according to claim 21 to 34 characterized by containing the copolymer compounded through the production process which carries out a polymerization reaction at at least two steps of different temperature which consist of production process; which adds again the monomer mixture which mixed an aromatic series vinyl monomer independent or the aromatic series vinyl monomer, and the acrylic ester (meta) monomer by the weight ratio 20:1–1:1, and carries out a polymerization reaction at the temperature of 55 degrees C or more.

[Claim 38] This binding resin is the image formation method according to claim 21 to 37 characterized by having number average molecular weight (Mn) of 2,500–50,000, and weighted mean particle weight (Mw) of 10,000–1,500,000.

[Claim 39] This toner is the image formation method according to claim 21 to 38 characterized by having a peak, respectively to a field of molecular weight 12,000–40,000, and a field of molecular weight 50,000–1,200,000 in molecular weight distribution by GPC of THF extractives of this toner.

[Claim 40] This toner is the image formation method according to claim 21 to 39 characterized by a ratio of area (L) of a with a molecular weight of 45,000 or less low-molecular-weight field and area (H) of the amount field of macromolecules exceeding molecular weight 45,000 satisfying following (relation L):(H) =1:9–9.5–0.5 in molecular weight distribution by GPC of THF extractives of this toner.

[Claim 41] This electrostatic latent-image supporter is the image formation method according to claim 21 to 40 characterized by being a photo conductor for electrophotography.

[Claim 42] This heating fixing means is the image formation method according to claim 1 to 41 characterized by being the heating pressurization roller anchorage device which has a heating roller and a pressurization roller.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the toner and electrophotography equipment which are used for a copying machine, a laser beam printer, a regular paper FAX, a color PPC, and a color laser beam printer and a color FAX.

[0002]

[Description of the Prior Art] In recent years, electrophotography equipment is shifting to a personal youth from the purpose of office use, and the technology of realizing a miniaturization, a maintenance free-lancer, etc. is searched for. Therefore, conditions, like maintenance nature, such as recycle of a waste toner, is good, and there is little ozone exhaust air are needed.

[0003] The copying machine of an electrophotography method and the printing process of a printer are explained. First, image support (a photo conductor is called below) is charged for image formation. There is a method charged in homogeneity in the photo conductor surface by the electrification method of the thing which uses the corona-electrical-charging machine used from the former as the electrification method, and the contact mold which aimed at reduction of an ozone yield in recent years, and pressed the conductive roller directly to the photo conductor etc. After charging a photo conductor, if it is a copying machine, light will be irradiated at a copy manuscript and the reflected light will be irradiated through a lens system at a photo conductor. Or if it is a printer, a picture signal will be formed in the light emitting diode and laser diode as the exposure light source, and a latent image will be formed in a photo conductor by ON-OFF of delivery and light. If a latent image (height of surface potential) is formed in a photo conductor, a photo conductor will be formed into a visible image with the toner (a diameter is 3 micrometers - about 12 micrometers) which is the coloring fine particles charged beforehand. A toner adheres to the photo conductor surface according to the height of the surface potential of a photo conductor, and is electrically imprinted by the copying paper. That is, the toner is beforehand charged in positive or negative, from the back of a copying paper, gives a polar charge opposite to toner polarity, and attracts it electrically. The thing which uses the corona discharge machine used from the former as the imprint method, and the imprint method which aimed at reduction of an ozone yield in recent years, and pressed the conductive roller directly to the photo conductor are put in practical use. At the time of an imprint, not all the toners on a photo conductor move to a copying paper, but a part remains on a photo conductor. This residual toner fails to be scratched by a cleaning blade etc. in the cleaning section, and turns into a waste toner. And the toner imprinted by the copying paper is fixed to paper by heat and the pressure at the production process of fixing.

[0004] There is a hot calender roll fixing method which passes between the pressure fixing method which passes between the metal rolls of two or more, the oven-fusing method which passes the inside of the heating ambient atmosphere by the electrical heater, and a heating roller as the fixing method. Since the surface of a heating roller and the toner side on a copying paper \*\*\*\*\* a hot calender roll fixing method, the thermal efficiency at the time of welding a toner image to a copying paper is good, and can be established quickly. However, by the hot calender roll fixing method, in order that a toner may \*\*\*\*\* in the state of heating melting on the heating

roller surface, there are a lifting and a cone defect about the offset phenomenon which some toners adhere to the roller surface, adheres on a copying paper again, and soils an image. As the method of carrying out offset prevention, the heating roller surface is formed by fluororesin and the silicone rubber which are rich in the mold-release characteristic over a toner with thermal resistance, and the method of supplying liquids for offset prevention, such as silicone oil, to the surface further, and covering the roller surface with the thin film of a liquid is taken. By this method, by heating liquids, such as silicone oil, the excessive equipment for generating an odor and supplying a liquid is needed, and the device of a reproducing unit becomes complicated. Moreover, in order to prevent offset with sufficient stability, it is necessary to control supply of a liquid in a high precision, and a reproducing unit cannot but become expensive. Then, even if it does not supply such a liquid, offset does not occur, but the toner with which a good fixing image is obtained is demanded.

[0005] The toner for electrostatic-charge development used for the electrophotography method as everyone knows is constituted by addition components, such as a release agent, the coloring component which generally consists of a resinous principle, a pigment, or a color and a plasticizer, a charge control agent, and also if needed. It is used by nature or synthetic resin as a resinous principle, mixing independently or timely.

[0006] And preliminary mixing of the above-mentioned additive is carried out at a suitable rate, heating kneading is carried out by thermofusion, and it pulverizes with an air-current type collision board method, and a fines classification is carried out and a toner parent is completed. An external additive is \*\*\*\*\*ed outside to this toner parent after that, and a toner is completed.

[0007] Although constituted from 1 component development by only the toner, 2 component developer is obtained by mixing with the carrier which consists of a toner and a magnetic particle.

[0008] Moreover, in a color copying machine, a photo conductor is electrified in the corona discharge by the electrification charger, a photo conductor is irradiated by making the latent image of each color into a lightwave signal after that, an electrostatic latent image is formed, negatives are developed by the 1st color, for example, a yellow toner, and a latent image is developed. After that, electrification of a yellow toner is contacted at a photo conductor in the imprint material charged in reversed polarity, and the yellow toner image formed on the photo conductor is imprinted. After a photo conductor cleans the toner which remained at the time of an imprint, it is discharged, and it finishes the development of the 1st color toner, and an imprint.

[0009] The method of piling up a repeat and the toner image of each color for the same actuation as a yellow toner on imprint material also to toners, such as a Magenta and cyanogen, after that, and forming a color image is taken. And after these superimposed toner images are imprinted by a toner and the transfer paper charged in reversed polarity, it is fixed to them and a copy ends them.

[0010] As this color image formation method, the toner image of each color is formed one by one on a single photo conductor. The imprint drum method which imprints in piles the toner image of each color by which is made to rotate the imprint material twisted around the imprint drum, and is made to counter this photo conductor repeatedly, and sequential formation is carried out there, The continuation pile method which arranges two or more image formation sections side by side, the imprint material conveyed by the belt is made to pass each image formation section, imprints the toner image of each color one by one, and piles up a color image is common.

[0011] On the other hand, there is JP,1-250970,A as an example of the color picture formation equipment using a continuation imprint method. In this conventional example, the form with which four image formation stations where each included the photo conductor, the light-scanning means, etc. for the image formation of four colors were conveyed by the list and the belt passes the lower part of each photo conductor, and a color toner image piles up.

[0012] The method of the toner image on this middle imprint material being put in block finally in piles, and once moving each color toner image by which sequential formation is carried out on a photo conductor considering the toner image of a different color on imprint material as other

methods of forming a color image in piles on middle imprint material, further again at a transfer paper is indicated by JP,2-212867,A.

[0013]

[Problem(s) to be Solved by the Invention] Needs, such as reusing the waste toner discarded without being reused conventionally, in order to regulate reduction of an ozone yield and unrestricted abandonment of industrial waste from the point of earth environmental protection these days, and the low-temperature fixing method of stopping the power consumption of fixing, are cried for. the correspondence to few roller transfer methods of generating of a toner material of the amount of ozone, the correspondence to waste toner recycle, and the formation of low-temperature fixing — amelioration is progressing that it should correspond. Furthermore, it is not independent and these highly efficient toners can be satisfied with coincidence of toners are important problems from environmental protection.

[0014] Moreover, the toner of a separate class is used for every model from which process speed differs in a copying machine, and a printer and FAX. For example, in a low-speed machine, in order to raise offset-proof nature, the binding resin material of high softening temperature with high viscoelasticity is used. In the high-speed machine, since it is hard to obtain quantity of heat required for fixing, in order to raise fixable, another binding resin with which the properties which lowered softening temperature differ is used. With regards to process speed, the peripheral velocity of a photo conductor is shown in the copy throughput per time amount of a machine. The bearer rate of a copying paper is decided by peripheral velocity of a photo conductor. If-izing of these separate toners can be carried out [ \*\*\*\* ], it will enable productive efficiency to also lower a riser and toner cost greatly.

[0015] At the production process of fixing, the fixing reinforcement which is the adhesion force of the toner to paper, and the offset-proof nature which prevents adhesion in a heating roller serve as a rule factor.

[0016] With the heat or pressure from a fixing roller, a toner carries out melting osmosis at the fiber of paper, and fixing reinforcement is obtained. In order to improve this fixing property, binding resin was improved conventionally, or the release agent etc. was added, the fixing reinforcement which fixes to paper was raised, and the offset phenomenon in which a toner adheres to a fixing roller is prevented.

[0017] In JP,59-148067,A, it has low molecular weight and the amount portion of macromolecules in resin, the partial saturation ethylene system polymer which specified the peak value and Mw/Mn of low molecular weight is used, and the toner containing the polyolefine which specified softening temperature is indicated. By this, it is supposed that fixable and offset-proof nature will be secured. Moreover, in JP,56-158340,A, the toner which uses as a principal component the resin which consists of a specific low-molecular-weight polymer component and an amount polymer component of macromolecules is indicated. It is the purpose which secures fixable by the low molecular weight constituent, and secures offset-proof nature by the amount component of macromolecules. Moreover, in JP,58-223155,A, it has the maximal value in the molecular weight field of 1000-10,000, and 200,000-1 million, and the toner containing the resin with which Mw/Mn consists of a partial saturation ethylene system polymer of 10-40, and the polyolefine which has specific softening temperature is indicated. It is used as a purpose which secures fixable by the low molecular weight constituent, and secures offset-proof nature with the amount component of macromolecules, and polyolefine.

[0018] However, if the resin which lowered the melt viscosity of binding resin or was low-molecular-weight-ized is used in order to raise the fixing reinforcement in a high-speed machine, and it is 2 component development, it will become easy to generate the so-called SUPENTO which a toner fixes on a carrier during long-term use. If it is 1 component development, on a doctor blade or a development sleeve, it will become easy to fix a toner and the stress-proof nature of a toner will fall. Moreover, if it is used for a low-speed machine, it will become easy to generate the offset in which a toner adheres to a heating roller at the time of fixing. Moreover, the blocking which toners weld during a mothball occurs.

[0019] Although it is possible to reconcile offset-proof nature with fixing reinforcement to the process speed of a short range depending on the configuration which blends the amount

component of macromolecules and a low molecular weight constituent, it is difficult to deal with a wide range process speed. In order to correspond to a wide range process speed, the effect of the degree which is making it the configuration of the higher amount component of macromolecules and a lower low molecular weight constituent can be demonstrated. However, although the effect which raises offset-proof nature by offset-proof nature's getting worse and making [ many ] the amount component of macromolecules in a low-speed machine although fixing reinforcement can be raised by making [ many ] a low molecular weight constituent in a high-speed machine is acquired, if the amount component of macromolecules is made [ many ], the evil of the grindability of a toner falling and productivity falling will arise.

[0020] Therefore, to the configuration to which copolymerization of the amount component of macromolecules and the low molecular weight constituent was blended or carried out, the release agent of the low melting point, for example, polyethylene, and a polypropylene wax are added in order to improve the mold-release characteristic from a heating roller at the time of fixing and to raise offset-proof nature.

[0021] However, it is difficult to raise the dispersibility in the inside of binding resin, and is easy to generate the reversed-polarity toner by the maldistribution, and fogging to the non-image section generates these release agents. Moreover, an image chip which was written to the solid black image section back end section with the brush arises, and image quality is worsened. Moreover, the technical problem which carries out filming contamination of a carrier, a photo conductor, and the development sleeve occurs.

[0022] Moreover, the elastic body blade which regulates a toner layer is used for developing rollers, such as silicon resin, and by the 1 component development method of the contact process possessing feed rollers, such as urethane resin which supplies a toner to a developing roller, the condensation by friction with the welding to a blade, a feed roller, and a developing roller occurs frequently, and it becomes the cause of a poor image. Therefore, when the resin which carried out macromolecule quantification is used, a load will be applied too much and the damage of the machine itself makes productivity fall greatly.

[0023] Moreover, it is desirable to recycle again the waste toner which remained on the photo conductor after the imprint and were collected from a viewpoint of earth environmental protection by the cleaning means in recent years as described above at a development production process. However, when a waste toner is recycled, a damage appears in a toner by the stress received within a duct in case a waste toner returns the cleaner section, the development section, and a waste toner to the development section.

[0024] Moreover, if the orientation for the particle to which especially distribution fell that an inner \*\* agent and a coloring agent were maldistributions to serve as a waste toner is strong and the toner in a development counter with new it is mixed in case the waste toner which failed to be scratched from a photo conductor at a cleaning production process is again recycled in development, the amount distribution of electrifications will become an ununiformity, a reversed-polarity toner increases, and the quality of a copy image deteriorates.

[0025] In the toner which furthermore added low melting point components, such as a wax, filming of the wax to a photo conductor is promoted and it becomes the factor of a life fall. Moreover, although conveyed according to frictional force with a photo conductor drum in a form with the short length of a postcard etc., in the photo conductor which filming generated, the conveyance force is reduced and it becomes poor postcard \*\*\*\*.

[0026] Moreover, the imprint method using the aforementioned conductive elastic roller makes a transfer paper insert in between image support and a conductive elastic roller, and although it imprints the toner which is on said image support surface by giving imprint bias voltage to said conductive elastic roller to a transfer paper, by the imprint method using this conductive elastic roller, the problem that soiling on the back of paper occurs is in a transfer paper. This is for contacting the rear face of a transfer paper to which the imprint roller which the imprint roller was in contact with image support by the predetermined pressure, the imprint roller polluted with the development production process by this fogging when there was much fogging, and was polluted with this toner has been sent in the condition that there is no transfer paper, when imprinting the toner on image support to a transfer paper using an imprint roller. Moreover, a

fluidity falls [ an inner \*\* agent ] with the toner of a maldistribution, and condensation of a toner becomes strong partially and tends to produce an inside omission at the time of an imprint. Moreover, this appears notably by the time of waste toner recycle.

[0027] Moreover, the mutual location of each color toner image in the case of forming a color image is made to agree by the imprint drum method by using an imprint drum, in order to double and pile up the location of the toner image of a different color, rotating this imprint drum at this speed to a photo conductor, and doubling the timing at the tip of an image further. However, with the above configurations, since it was necessary to twist a form around an imprint drum, it was required more than magnitude with the fixed path of an imprint drum, and the structure was very complicated, and since high degree of accuracy was required, equipment became large-scale and expensive. Moreover, since it was not able to twist around an imprint drum, forms with the strong waist, such as a postcard and pasteboard, were not able to be used.

[0028] Although such an imprint drum was unnecessary on the other hand in order for what is necessary to be for the continuation imprint method to have the image formation location corresponding to the color number, and just to pass a form there one after another, two or more latent-image means forming, such as a laser beam study system for forming a latent image on a photo conductor by this method, was necessities corresponding to the number of colors, and structure was very complicated and expensive. Since there were two or more image formation locations, it was difficult for a gap of a relative location gap of the image formation section of each color, the eccentricity of the axis of rotation, and the parallelism of each part etc. to influence a direct color gap, and to obtain high definition to stability further again. Alignment between each color of the latent image especially by latent-image means forming needed to be performed correctly, and there was a trouble that a considerable device and a complicated configuration were required for the image exposure system which is latent-image means forming as shown also in JP,1-250970,A.

[0029] Furthermore, in the example of JP,2-212867,A using middle imprint material, in order to form the toner image of each color on the same photo conductor, two or more development counters must be arranged around a single photo conductor, and the configuration of a photo conductor becomes large inevitably, and it has become the belt configuration which a photo conductor cannot deal with easily. Moreover, in matching adjustment with the property of a photo conductor being required if each development counter is exchanged at the time of a maintenance, since positioning between each development counter was required at the time of exchange of a photo conductor, the maintenance of each color development counter or a photo conductor was also difficult.

[0030] However, when a middle imprint method does not need complicated optical system, and can use it also for a form with the strong waists, such as a postcard and pasteboard, and a middle imprint belt is used, since it is flexible, it has the merit which enables the miniaturization of equipment itself compared with an imprint drum method and a continuation imprint method.

[0031] Moreover, although it is an ideal that a toner is altogether imprinted at the time of an imprint, the imprint remainder arises in part. The so-called imprint effectiveness is not 100%, and, generally is about 75 - 90%. The toner of this imprint remainder fails to be scratched by a cleaning blade etc. at the production process of photo conductor cleaning, and turns into a waste toner.

[0032] However, with the configuration which uses a middle imprint object, even if a toner will pass through at least 2 times or more of imprint production processes from a photo conductor from a middle imprint object to television paper further to a middle imprint object and has 85% of imprint effectiveness in the copying machine of the usual 1-time imprint, for example, imprint effectiveness falls even to 72% by two imprints. The toner of 56% and abbreviation one half must turn into a waste toner, and what is 75% of imprint effectiveness in a 1 more time imprint must make bigger cost rise of a toner, and capacity of a waste toner box, and, now, cannot perform the miniaturization of equipment. The ground fogging and imprint omission of reversed polarity according [ the decline in imprint effectiveness ] to a maldistribution are considered to be a factor.

[0033] Moreover, in the case of color development, in order to pile up the toner image of four

colors on a middle imprint object, a toner layer becomes thick, there is no toner layer, or differential pressure with a thin place tends to produce it. For this reason, it is easy to generate the "Naka omission" phenomenon which serves as a hole, without some images being imprinted by the condensation effect of a toner. Furthermore, if the high material of the mold release effect of a toner is used for a middle imprint object in order to ensure cleaning at the time of getting television paper blocked, an inside omission will appear notably and will reduce the grace of an image remarkably. Furthermore, in an alphabetic character or Rhine, it is edge development and more toners become remarkable from a lifting and an extraction injury about condensation of a paste and the toners by pressurization. It appears more notably under highly humid hot environment especially.

[0034] Moreover, it is the configuration which has the image formation unit group which has arranged two or more movable image formation units which form the toner image of a different color with the electrophotography equipment mentioned later in the shape of a circular ring, and the whole image formation unit rotates. It is the configuration in which exchange in every image formation unit and middle imprint unit is still more possible, if a life comes and it comes at an exchange stage, it can maintain easily by the exchange for every unit, and it becomes possible to obtain about the same maintenance nature as black and white also in an electrophotography color printer. However, in order for the waste toner cleaned since the image formation unit itself revolved around the sun to carry out repeat adhesion temporarily at a photo conductor and to repeat balking from a developing roller, and adhesion, it becomes easy to produce the damage and filming to a photo conductor, and initial fogging will be induced if the standup nature of electrification is bad in the early stages of development.

[0035] Moreover, in fixing of this 4 color toner image, it is necessary to carry out color mixture of the color toner. At this time, in the portion which lapped while dispersion of light arose in the toner image surface or the interior and the color tone of toner coloring matter original was spoiled, when the lack of fusion of a toner happened, light does not carry out incidence to a lower layer, but color reproduction nature falls. Therefore, it is a requirement to have a perfect melting property in a toner and to have translucency which does not bar a color tone. By the increment in the presentation opportunity in a color, the light transmission nature in an OHP form is larger [ the necessity ] especially.

[0036] However, with the configuration of such resin, since offset-proof nature falls, and it is not altogether fixed to a form, but it adheres to the fixing roller surface and offset arises when it is going to improve a melting property more, a lot of oil etc. must be applied to a fixing roller, and handling and the configuration of a device become complicated.

[0037] Moreover, it must add so much, and although there is also the method of adding release agents, such as polypropylene and polyethylene, and raising offset-proof nature, in the binding resin of the above-mentioned Sharp melt, the dispersibility will fall remarkably, muddiness of a color will arise and color reproduction nature will fall.

[0038] Moreover, the report from which fixable [ which suppressed color muddiness and was excellent in adding carnauba wax so much in JP,5-119509,A and JP,8-220808,A ], and offset-proof nature are obtained is made.

[0039] However, only by adding carnauba wax etc., as stated also in advance, generating of filming to ground fogging accompanying a maldistribution, a photo conductor, a developing roller, and a middle imprint object and a poor imprint are induced, and these phenomena become remarkable more in a waste toner recycle process further.

[0040] Moreover, the configuration which adds the compound which has a fluorine element by JP,3-213873,A and JP,5-333584,A is proposed. It is supposed that a mold-release characteristic can be raised more by this. However, if negative electrification nature becomes strong too much and uses it over a long period of time repeatedly by adding this material, a toner will produce fault electrification and will produce the fall of image concentration, and the fall of imprint nature. It generates more notably especially in the use under low-humidity/temperature. Moreover, strong orientation has condensation by toner particles, it falls out during the vertical reinforcement on a developing roller, or an imprint, and causes [ of the rate of an imprint ] a fall. In 4 color full color image, it generates more notably especially.

[0041] And a toner must be synthetically satisfied to the above-mentioned technical problem.

[0042] This invention raises the dispersibility of the inner additive of a coloring agent in binding resin in view of the above-mentioned trouble, and it aims at offering the toner and electrophotography equipment which have uniform electrification distribution.

[0043] Moreover, it aims at offering the toner for full color electrophotography and electrophotography equipment of oilless fixing which do not carry out oil spreading.

[0044] Moreover, it aims at offering the toner and electrophotography equipment which can maintain the development nature which produced neither the heat welding of a toner, nor condensation even if it used it for the 1 component developing-negatives method of a contact process, and raised the dispersibility of an additive, without degrading a resin property even if it used highly efficient binding resin, and was stabilized.

[0045] Moreover, it aims at offering the toner and electrophotography equipment which it can be compatible in fixable and offset-proof nature, and excels in dispersibility, and electrification nature is stabilized, and make high definition possible also in the model from which process speed differs broadly.

[0046] Moreover, the inside omission at the time of an imprint and spilling are prevented by the conductive elastic roller and the electrophotography method using a middle imprint object, and it aims at offering the toner and electrophotography equipment with which high imprint effectiveness is acquired.

[0047] Moreover, it aims at offering the toner and electrophotography equipment which can prevent filming of a photo conductor and a middle imprint object also in the long-term use under highly humid.

[0048] Moreover, it aims at offering the toner and electrophotography equipment which there are not the amount of electrifications of a developer and a fluid fall, an aggregate is not produced even if it recycles a waste toner, but reinforcement is attained, enable recycle development, and enable the re-activity of earth environmental pollution prevention and a resource.

[0049]

[Means for Solving the Problem] A configuration of a toner applied to this invention in view of the above-mentioned technical problem is characterized by adding an external additive which becomes the toner parent which consists of a polymer, with an acid numbers of ten or more polyester resin, and a coloring agent which contain a fluorine at least from a hydrophobic silica which has positive electrification nature at least.

[0050] Moreover, a configuration of a toner concerning this invention is characterized by adding an external additive which becomes the toner parent which consists of a polymer, with an acid numbers of ten or more polyester resin, and a coloring agent which contain a fluorine at least from a hydrophobic silica which has positive electrification nature at least, and a hydrophobic silica which has negative electrification nature.

[0051] Moreover, a configuration of a toner concerning this invention is characterized by adding an external additive which becomes the toner parent which consists of a polymer, with an acid numbers of ten or more polyester resin, and a coloring agent which contain a fluorine at least from a hydrophobic silica and low resistance metallic-oxide impalpable powder which have positive electrification nature at least.

[0052] Moreover, a configuration of a toner concerning this invention is characterized by adding an external additive which becomes the toner parent which consists of a polymer, with an acid numbers of ten or more polyester resin, and a coloring agent which contain a fluorine at least from titanate system impalpable powder or zirconia acid chloride system impalpable powder a hydrophobic silica which has positive electrification nature at least, mean particle diameter of 0.02-4 micrometers, and whose BET specific surface area by nitrogen adsorption are 0.1-100m<sup>2</sup>/g.

[0053] Furthermore, a configuration of a toner concerning this invention carries out 0.5-4 weight section content of the charge control agent which consists of a metal complex of a salicylic-acid metal complex and/or a benzilic-acid derivative per toner parent 100 weight section.

[0054] Furthermore, a configuration of a toner concerning this invention consists of metallic-oxide impalpable powder with which low resistance metallic-oxide impalpable powder consists of

at least one or more kinds in titanium oxide impalpable powder mean particle diameter of 0.02–2 micrometers and whose BET specific surface area by nitrogen adsorption are 0.1–100m<sup>2</sup>/g, and whose electrical resistivity is below 10<sup>9</sup>-ohmcm, aluminum oxide impalpable powder, strontium-oxide impalpable powder, tin oxide impalpable powder, oxidation zirconia impalpable powder, magnesium-oxide impalpable powder, and indium oxide impalpable powder.

[0055] Furthermore, a configuration of a toner concerning this invention consists of titanium oxide and/or oxidation silica impalpable powder by which surface coating processing of the low resistance metallic-oxide impalpable powder was carried out with mixture of mean particle diameter of 0.02–2 micrometers, and tin-oxide-antimony of 1–200m<sup>2</sup>/[ of BET specific surface areas ] g by nitrogen adsorption.

[0056] Furthermore, as for a configuration of a toner concerning this invention, a BET specific surface area by nitrogen adsorption by which a hydrophobic silica was processed by at least one or more kinds in dimethyl silicone oil, methylphenyl silicone oil, alkyl denaturation silicone oil, fluorine denaturation silicone oil, amino denaturation silicone oil, and epoxy denaturation silicone oil consists of 30–350m<sup>2</sup>/g.

[0057] Furthermore, as for a configuration of a toner concerning this invention, titanate system impalpable powder or zirconia acid chloride system impalpable powder is created by hydrothermal method or oxalate thermal decomposition method.

[0058] Furthermore, specific gravity [ in / in a polymer containing a fluorine / 25 degrees C ] sets to 1.05 or more and a differential scanning calorimetry, and a configuration of a toner concerning this invention is the tangent melting point temperature at the time of a temperature up (with a tangent of a start curve at the time of endothermic initiation at the time of a temperature up), an intersection with a tangent of a curve which tends toward a peak after starting — tangent melting point temperature — carrying out — a difference of 73 degrees C – 148 degrees C, peak temperature, and tangent melting point temperature is 70–140 degrees C, and peak temperature is 20K or less thing.

[0059] Furthermore, a polymer with which a configuration of a toner concerning this invention contains a fluorine is [ mean particle diameter ] 1–11 micrometers.

[0060] Furthermore, a configuration of a toner concerning this invention is the thing of  $0.3 < FP/TP < 0.9$ , when mean particle diameter of FP and a toner is set to TP for mean particle diameter of a polymer containing a fluorine.

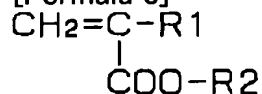
[0061] Furthermore, a polymer with which a configuration of a toner concerning this invention contains a fluorine consists of a copolymer of an olefin and tetrafluoroethylene.

[0062] Furthermore, a polymer with which a configuration of a toner concerning this invention contains a fluorine consists of partial fluoridation, jojoba oil which carried out the extreme fluoridation, or a meadowfoam oil.

[0063] furthermore, a polymer with which a configuration of a toner concerning this invention contains a fluorine — tetrafluoroethylene — and/or (\*\* 3) (\*\* 4), it consists of a copolymer with acrylic ester shown.

[0064]

[Formula 3]

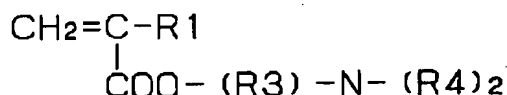


( R 1 は水素原子又は炭素数 3 までの低級アルキル基、  
R 2 は炭素数 16 ~ 25 のアルキル基 )

[0065]

[Formula 4]





(R1は水素原子又は炭素数3までの低級アルキル基、  
R3は $\text{C}_n\text{H}_{2n}$ ( $n: 1 \sim 5$ )、R4は炭素数1～5のアルキル基)

[0066] Furthermore, the polymer with which the configuration of the toner concerning this invention contains a fluorine consists of tetrafluoroethylene, an olefin, the above (\*\* 3), and/or (\*\* 4) a copolymer with the acrylic ester shown.

[0067]

[Embodiment of the Invention] Homogeneity dry blending of the inner \*\* agents, such as the binding resin, the coloring agent and the fixing assistant which is the component of a toner, and other charge control agents add if needed, carries out by preliminary mixing, and a toner is create by carry out outside \*\*\*\*\* processing in an external additive in this gestalt by the toner parent which is the coloring particle which carried out melting kneading with heat, distributed the coloring agent and the inner \*\* agent in binding resin, and was made into predetermined particle size distribution by grinding classification processing after cooling.

[0068] In order to aim at coexistence of high translucency and offset-proof nature without using the oil for offset prevention for digital high definition, high coloring repeatability colorization, and a fixing roller, the narrow melt sharply binding resin of molecular weight distribution with few amount components of macromolecules was used. Although translucency was securable with this configuration, since offset arose, there was the necessity of applying oil to a fixing roller. It succeeds also in the attempt which furthermore adds polypropylene and release agents, such as polyethylene, to a toner, and raises a mold-release characteristic. However, in binding resin [ melt / only by adding / sharply ], especially polyester resin, distribution is very difficult, and un-arranging, such as deterioration of filming to fogging, a photo conductor, or a developing roller and the start of electrification and a fall of the image concentration by the amount fall of charges at the time of repetition use, occur.

[0069] However, it not only becomes possible to prevent offset to a fixing roller, without carrying out oil spreading, but by adding the polymer containing a fluorine as a fixing assistant, dispersibility in resin is made with homogeneity and it can prevent filming to a photo conductor. Moreover, even if it carries out repeat use, the fall of electrification does not arise but can output the stable image.

[0070] However, if negative electrification nature becomes strong too much and uses it over a long period of time repeatedly by adding this material, a toner will produce fault electrification and will produce the fall of image concentration, and the fall of imprint nature. It generates more notably especially in the use under low-humidity/temperature. Moreover, strong orientation has condensation by toner particles, it falls out during the vertical reinforcement on a developing roller, or an imprint, and causes [ of the rate of an imprint ] a fall. In 4 color full color image, it generates more notably especially.

[0071] Then, by using it combining the hydrophobic silica which has positive electrification nature as a silica of an external additive as an external additive, coherent was suppressed, the omission could be prevented during the imprint and it became clear that an image property could be stabilized in the continuous duty under low-humidity/temperature. Furthermore, stability improves more by using it, mixing with the method of using it, mixing with a negative electrification nature silica, the method of using it, mixing with a low resistance metallic oxide, and metal acid chloride system impalpable powder.

[0072] A positive electrification nature silica is processed by the amino silane, amino denaturation silicone oil, and epoxy denaturation silicone oil.

[0073] In order to raise hydrophobic processing furthermore, concomitant use of processing by hexamethyldisilazane, dimethyldichlorosilane, and other silicone oil is also desirable. For example, it is desirable to process by at least one or more kinds in dimethyl silicone oil, methylphenyl silicone oil, and alkyl denaturation silicone oil.

[0074] Moreover, as a silane coupling processing agent, there are dimethyldichlorosilane, a trimethyl KURORU silane, an allyl compound dimethyl KURORU silane, hexamethyldisilazane, an allyl compound phenyl dichloro silane, a benzyl methyl KURORU silane, vinyltriethoxysilane, gamma-methacryloxypropyltrimethoxysilane, vinyltriacetoxysilane, a divinyl KURORU silane, a dimethyl vinyl KURORU silane, etc. Silane coupling agent processing is processed by the wet method which carries out the dropping reaction of the dry type processing to which the silane coupling agent which evaporated pulverized coal to what was made into the shape of a cloud by stirring etc. is made to react, or the silane coupling agent which distributed pulverized coal in the solvent.

[0075] That by which the negative electrification nature silica was processed by silicone oil, such as dimethyl silicone oil, methylphenyl silicone oil, fluorine denaturation silicone oil, and alkyl denaturation silicone oil, is used suitably.

[0076] Processing has the method of mixing silica impalpable powder and the material of a silicone oil system with mixers, such as a Henschel mixer, the method of removing and creating a solvent, after making the method and solvent which spray the material of a silicone oil system to a silica dissolve or distribute the material of a silicone oil system and mixing with silica impalpable powder, etc. It is desirable that 0.1–8 weight section combination of the material of a silicone oil system is carried out to the silica 100 weight section.

[0077] At this time, the BET specific surface area according [ a silica ] to nitrogen adsorption \*\*\*\*\* the hydrophobic silica of 30–350m<sup>2</sup>/g outside to a toner parent. It is desirable 50–300m<sup>2</sup>/g and that a more desirable specific surface area is in the range of 80–250m<sup>2</sup>/g still more preferably. If specific surface area is smaller than 30m<sup>2</sup>/g, the fluidity of a toner will not improve but conservation stability will fall. If specific surface area is larger than 350m<sup>2</sup>/g, condensation of a silica will get worse and uniform outside \*\*\*\*\* will become difficult. a hydrophobic silica — the toner parent particle 100 weight section — hitting — 0.1 – 5 weight section — 0.2–3 weight section combination is carried out preferably. if smaller than the 0.1 weight section — the fluidity of a toner — \*\*\*\*\* — if larger than 5 weight sections, a suspension silica will increase and the inside of a plane will be polluted.

[0078] Moreover, as for the mixed ratio of a positive electrification nature silica and a negative electrification nature silica, mixing at a rate of 100:0–55:45 is desirable. It is 90:10–65:35 preferably [ it is more desirable and ] to 95:5–60:40, and a pan. If the rate of a negative electrification nature silica exceeds 45, fault electrification will become intense and solid imitation nature will get worse.

[0079] The amount of electrifications of a silica is measured by the blowing off method of frictional electrification with the ferrite carrier of a non coat. After mixing carrier 50g and silica 0.1g in the 100ml polyethylene container under the environment of 25-degree–C45%RH and stirring for 5 minutes and 30 minutes at the rate of 100min<sup>-1</sup> by vertical rotation, 0.3g was extracted and 60sec blow was carried out with nitrogen gas 1.96x10<sup>4</sup> (Pa).

[0080] In a positive electrification nature silica, it is desirable that a 5-minute value is [ the value for 30 minutes ] +50–+400microC/g in +100–+800microC/g. The silica to which the amount of electrifications in a value is maintaining 40% or more of the amount of electrifications in a value for 5 minutes for 30 minutes is desirable. When a decreasing rate is large, change of the amount of electrifications of a under [ long-term continuous duty ] is large, and it becomes impossible to maintain a fixed image.

[0081] In a negative electrification nature silica, it is desirable that a 5-minute value is [ the values for 30 minutes ] –50 – –400microC/g in –100 – –800microC/g. By the silica of the high amount of electrifications, a function can be demonstrated with a little addition.

[0082] A property is stabilized more by adding the metallic-oxide impalpable powder which consists of at least one or more kinds in the titanium oxide impalpable powder the mean particle diameter of 0.02–2 micrometers and whose BET specific surface area by nitrogen adsorption are 0.1–100m<sup>2</sup>/g as non-metallic-oxide impalpable powder which furthermore has low resistance, and whose electrical resistivity is below 10<sup>9</sup>-ohmcm, aluminum oxide impalpable powder, strontium-oxide impalpable powder, tin oxide impalpable powder, oxidation zirconia impalpable powder, magnesium-oxide impalpable powder, and indium oxide impalpable powder outside.

[0083] For the mean particle diameter of 0.02–0.8 micrometers, and the BET specific surface area by nitrogen adsorption, 1.0–85m<sup>2</sup>/g, and the mean particle diameter of 0.02–0.1 micrometers and the BET specific surface area by nitrogen adsorption are [ 8–85m<sup>2</sup>/g, and the mean particle diameter of 0.02–0.06 micrometers and the BET specific surface area by nitrogen adsorption ] 10–85m<sup>2</sup>/g still more preferably still more preferably more preferably.

[0084] Fault electrification of the frictional electrification of a toner and a feed roller is carried out during continuation long-term use, it makes it improve that the fall of the amount of toner conveyances on a developing roller and poor imitation nature get worse, and the effect that the fault electrification is prevented and high image concentration and poor imitation nature can be maintained is acquired. In the feed roller which used especially urethane resin, it acts more effectively.

[0085] Furthermore imprint nature is improved, \*\* can suppress coherent [ of a toner ], and can prevent an omission during an imprint, an image property can be stabilized in the continuous duty under low-humidity/temperature, and an effect is acquired by maintenance of image concentration.

[0086] When the BET specific surface area according [ mean particle diameter ] from 0.02 micrometers to smallness and nitrogen adsorption becomes larger than 100m<sup>2</sup>/g, coherent is strong, homogeneity distribution at the time of outside \*\*\*\*\* cannot be performed, and the above-mentioned effect does not demonstrate. If electrical resistivity becomes larger than 10<sup>9</sup>-ohmcm, the above-mentioned effect will fall. If the BET specific surface area according [ mean particle diameter ] from 2 micrometers to size and nitrogen adsorption becomes smaller than 0.1m<sup>2</sup>/g, balking from a toner parent will become severe, and will affect endurance, and the damage to a photo conductor will become large.

[0087] Furthermore, by adding the metallic-oxide impalpable powder which consists of the titanium oxide and/or oxidation silica impalpable powder by which surface coating processing was carried out with the mixture of the tin-oxide-antimony of 1–200m<sup>2</sup>/[ of BET specific surface areas ] g by nitrogen adsorption Since fault electrification of the frictional electrification of a toner and a feed roller is carried out during continuation long-term use and the fall of the amount of conveyances on the developing roller of a toner and poor imitation nature get worse, the effect that the fault electrification can be prevented, image concentration can be maintained, and poor imitation nature can be improved is acquired. In the feed roller which used especially urethane resin, it acts more effectively.

[0088] When larger than 200m<sup>2</sup>/g, mixed processing cannot carry out to homogeneity, but in being smaller than 1m<sup>2</sup>/g, the desorption from a toner increases and it falls the endurance of a toner.

[0089] When this used it combining the binding resin of this configuration, and a fixing assistant, the nonuniformity of the stratification on the developing roller by contamination could be stopped, and it found out that it enabled fogging at the time of development, and the concentration fall at the time of long-term continuous duty to protect further.

[0090] Furthermore, a better property is shown in a toner parent by carrying out outside \*\*\*\*\* addition processing of the metal acid chloride impalpable powder with a hydrophobic silica. Imprint nature is improved, while being able to stabilize electrification nature more and being able to improve waste toner recycle nature by adding the metal acid chloride impalpable powder which consists of at least one or more kinds in the titanate system impalpable powder the mean particle diameter of 0.02–4 micrometers and whose BET specific surface area by nitrogen adsorption are 0.1–100m<sup>2</sup>/g, or zirconia acid chloride system impalpable powder to a toner parent. By the system which added especially the fixing assistant, there is orientation that it is easy to form fault electrification during long-term continuous duty under low-humidity/temperature, and it becomes the factor which reduces image concentration. The effect of preventing it is demonstrated. Moreover, an effect is in the maintenance nature of the amount of electrifications at the time of stabilization of electrification at the time of waste toner recycle, prevention of filming, and the continuous duty under damp.

[0091] As a material, SrTiO<sub>3</sub>, BaTiO<sub>3</sub>, MgTiO<sub>3</sub>, AlTiO<sub>3</sub>, CaTiO<sub>3</sub>, PbTiO<sub>3</sub>, FeTiO<sub>3</sub>, SrZrO<sub>3</sub>, BaZrO<sub>3</sub>, MgZrO<sub>3</sub>, AlZrO<sub>3</sub>, CaZrO<sub>3</sub>, PbZrO<sub>3</sub>, SrSiO<sub>3</sub>, BaSiO<sub>3</sub>, MnSiO<sub>3</sub>, CaSiO<sub>3</sub>, and MgSiO<sub>3</sub> are

mentioned.

[0092] Moreover, an effect increases more by creating such metal acid chloride impalpable powder by the hydrothermal method or the oxalate thermal decomposition method. The material with which these were generated is because the configuration where particle size distribution gathered serves as a near form more nearly spherical than an indeterminate form. Condensation of a grain child with the larger BET specific surface area according [ mean particle diameter ] to smallness and nitrogen adsorption than 100m<sup>2</sup>/g is stronger than 0.02 micrometers, and dispersibility falls. The damage to the photo conductor by the grain child with the BET specific surface area smaller than 0.1m<sup>2</sup>/g according [ mean particle diameter ] to size and nitrogen adsorption increases from 4 micrometers.

[0093] As a synthesis method of the impalpable powder under these hydrothermal conditions, there are a hydrothermal oxidation style, a hydrothermal precipitation method, a hydrothermal crystallization method, a hydrothermal variational method, the hydrothermal crystallizing method, the hydrothermal hydrolyzing method, hydrothermal ATORIDA alligation, the hydrothermal mechanochemical method, etc. Preferably, they are a hydrothermal oxidation style, a hydrothermal precipitation method, a hydrothermal crystallization method, a hydrothermal variational method, and the hydrothermal hydrolyzing method.

[0094] Spherical impalpable powder with a fluidity sufficient [the impalpable powder compounded by this method] with narrow particle size distribution with little condensation is obtained.

Therefore, when outside \*\*\*\*\* processing is carried out at a toner, dispersibility is good and adheres to a toner at homogeneity. And since the configuration is spherical, an unnecessary blemish is not given to a photo conductor. Moreover, in order that moderate \*\* may show \*\* in cleaning, cleaning nature is raised without making coefficient of friction increase, and an effect is acquired by prevention of filming at the time of using the diameter[ of a granule ]-ized toner which added especially the fixing assistant. 0.1 – 5 weight section has the desirable addition of the metallic-oxide impalpable powder added by the toner outside and/or metal acid chloride impalpable powder to the toner parent 100 weight section. If smaller than 0.1, a function will not be demonstrated, but if larger than 5, moisture resistance will get worse.

[0095] It is desirable that 70–140 degrees C and peak temperature are [ the specific gravity in 25 degrees C / the differences of 73 degrees C – 148 degrees C, peak temperature, and tangent melting point temperature ] 20K or less in 1.05 or more and a differential scanning calorimetry as a polymer containing a fluorine for the tangent melting point temperature at the time of a temperature up (the intersection of the tangent of the start curve at the time of the endothermic initiation at the time of a temperature up and the tangent of the curve which tends toward the peak after starting is made

[0096] It is desirable more preferably that 75–135 degrees C and peak temperature are [ the specific gravity in 25 degrees C / the differences of 78 degrees C – 143 degrees C, peak temperature, and tangent melting point temperature ] 18K or less for 1.08 or more and the tangent melting point temperature at the time of a temperature up.

[0097] It is desirable that 78–132 degrees C and peak temperature are [ the specific gravity in 25 degrees C / the differences of 81 degrees C – 140 degrees C, peak temperature, and tangent melting point temperature ] 16K or less for 1.1 or more and the tangent melting point temperature at the time of a temperature up still more preferably.

[0098] If specific gravity is smaller than 1.05, a fluorine ratio will decrease and the offset-proof effect will fall.

[0099] If tangent melting point temperature is smaller than 70 degrees C, shelf life will get worse and it will lifting-come to be easy of heat condensation. Moreover, filming is produced in a photo conductor at a middle imprint object or a developing roller. If tangent melting point temperature is larger than 140 degrees C, while the offset-proof effect will fall, dispersibility falls and increase of the amount of waste toners and fogging increase.

[0100] If peak temperature is smaller than 73 degrees C, shelf life will get worse and it will lifting-come to be easy of heat condensation. Moreover, filming is produced in a photo conductor at a middle imprint object or a developing roller. If peak temperature is larger than 148 degrees C, while the offset-proof effect will fall, dispersibility falls and increase of the amount of waste

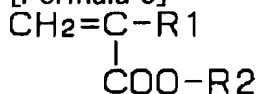
toners and fogging increase.

[0101] When the difference of peak temperature and tangent melting point temperature is larger than 20K, in order for many low temperature fusion components below peak temperature to contain, the dispersibility at the time of kneading falls and increase of the amount of waste toners and the increment in fogging are caused. Moreover, it becomes easy to produce filming in a photo conductor at a middle imprint object or a developing roller.

[0102] as the polymer containing a fluorine — the copolymer of an olefin and tetrafluoroethylene, the partial fluoridation, the jojoba oil that carried out the extreme fluoridation or a meadowfoam oil, and tetrafluoroethylene — and/or (\*\* 5) (\*\* 6), the copolymer with acrylic ester, the tetrafluoroethylene, and the olefin which are shown — and/or (\*\* 5) (\*\* 6), it is the material with which the acrylic ester copolymer shown suits. a simple substance — or you may mix and use it.

[0103]

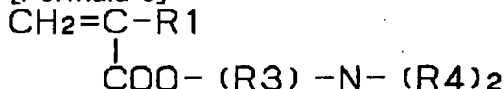
[Formula 5]



(R 1 は水素原子又は炭素数3までの低級アルキル基、  
R 2は炭素数16～25のアルキル基)

[0104]

[Formula 6]



(R 1 は水素原子又は炭素数3までの低級アルキル基、  
R 3は $\text{C}_n\text{H}_{2n}$  (n : 1 ~ 5) 、R 4は炭素数1～5のアルキル基)

[0105] a meadowfoam oil and the original name — Lim Nunn Tess Alva is triglyceride which extracts the seed of the meadowfoam belonging to the department of FUUROU eye Lim Nunn Tess, squeezes, and is obtained. Many ray KOSEN acids are contained and erucic acid and its isomer are in the fatty acid of 22:1 including 20 or more C long chain fatty acid. Most unsaturated fatty acid is monoene acids, it is [ whenever / partial saturation ] low and oxidation stability is good.

[0106] Jojoba oil is a wax ester system wax of a partial saturation higher fatty acid and alcohol extracted from the fruit of a jojoba. As for the carbon number, C40 and C42 are almost the case. The slack wax obtained by squeezing is a liquid, and if it refines, it will become transparent and colorless.

[0107] The polyethylene wax, the polypropylene wax, and the chemical structure which have generally been used from the former differ from each other, and these fixing assistants have the characteristic outstanding effect.

[0108] The fluoridation of the fluoridation meadowfoam oil is carried out to a meadowfoam oil, and it considers an unsaturated bond as saturation association. Extreme or the thing which carried out the partial fluoridation is desirable.

[0109] The fluoridation of the fluoridation jojoba oil is carried out to jojoba oil, and it considers an unsaturated bond as saturation association. Extreme or the thing which carried out the partial fluoridation is desirable.

[0110] As an addition, 0.1 – 20 weight section is desirable to the toner 100 weight section. If smaller than the 0.1 weight section, the effect of fixable and offset-proof nature will not be acquired, but a technical problem arises in that storage stability will fall if larger than 20 weight sections, and grindabilitys, such as overgrinding.

[0111] moreover, the concomitant use with other components — being possible . For example, derivatives, such as higher fatty acids, such as polyolefine waxes, such as vegetable system

waxes, such as a cull UNABA wax, a candelilla wax, lanolin, haze wax, beeswax, an ozokerite, a ceresin, and a rice wax, polyethylene, and polypropylene, a fatty-acid amide, stearin acid, a palmitic acid, a lauric acid, aluminum stearate, barium stearate, zinc stearate, and palmitic-acid zinc, or a metal object of those, and ester, are possible also for one kind or the use combined two or more kinds. A fixing property improves more by using the cull UNABA wax especially whose melting point is 70–95 degrees C. 1 – 10 weight section of an addition is desirable.

[0112] While acting on a fixing disposition as a fixing assistant and strengthening an adhesive property with paper with the toner containing these, the frictional resistance on the surface of an image in the paper is decreased, and the effect of suppressing the exfoliation from the paper of the toner by scratch, and raising fixable is acquired. Furthermore, to the color toner of which translucency is required, translucency can be raised more and coexistence with offset-proof nature can be aimed at.

[0113] Furthermore, polyester resin is used as binding resin of a toner, and stabilization of electrification nature is attained by making the acid number of the polyester resin or more into ten. Moreover, it becomes possible to also prevent toner condensation, and even if it uses it continuously for a long period of time, it becomes possible to prevent a photo conductor, a middle imprint object, and filming to a developing roller. It is because distribution of the fixing assistant in the time of kneading can be made better, and it is thought that it is effective in the ability to hold a charge on fixed level with the acid number of a positive electrification nature silica and resin. When smaller than 10, it is in the orientation for fogging to increase.

[0114] As for the acid number, 10–100 are desirable, and it is 15–80 more preferably. It is 20–50 still more preferably. If smaller than 10, the dispersibility of a fixing assistant will fall. If it becomes larger than 100, moisture resistance will fall.

[0115] The configuration whose \*\* high translucency and high color reproduction nature can be secured, fixing oil is not needed, but can also expand offset width of face even in a high temperature region more by using together with the polyester resin which possesses the fixed amount component of macromolecules to binding resin was created.

[0116] The polyester resin from which the binding resin used suitable for this gestalt is obtained according to a polycondensation with carboxylic-acid components, such as an alcoholic component, a carboxylic acid, carboxylate, and a carboxylic anhydride, is used suitably.

[0117] As a divalent carboxylic acid or low-grade alkyl ester, aromatic series dibasic acids, such as aliphatic series partial saturation dibasic acids, such as aliphatic series dibasic acids, such as a malonic acid, a succinic acid, a glutaric acid, an adipic acid, and hexahydro phthalic anhydride, a maleic acid, a maleic anhydride, a fumaric acid, an itaconic acid, and a citraconic acid, and phthalic anhydride, a phthalic acid, a terephthalic acid, and isophthalic acid, and these methyl ester, ethyl ester, etc. can be illustrated. In this, aromatic series dibasic acids and those low-grade alkyl ester, such as a phthalic acid, a terephthalic acid, and isophthalic acid, are desirable.

[0118] As a carboxylic-acid component more than trivalent, 1,2,4-benzenetricarboxylic acid, 1, 2, 5-benzene tricarboxylic acid, 1 and 2, 4-cyclohexane tricarboxylic acid, 2, 5, 7-naphthalene tricarboxylic acid, 1 and 2, 4-naphthalene tricarboxylic acid, 1, 2, 4-butane tricarboxylic acid, 1 and 2, 5-hexa tricarboxylic acid, 1, a 3-dicarboxyl 2-MECHIRU 2-methylene KARUBOKI propane, Tetrapod (methylene carboxyl) methane, 1, 2 and 7, 8-octane tetracarboxylic acid, pyromellitic acid, en pole trimer acids and these acid anhydrides, alkyl (carbon numbers 1–12) ester, etc. are mentioned.

[0119] as dihydric alcohol — diols, such as ethylene glycol, 1, 2-propylene glycol, 1, 3-propylene glycol, 1, 3-butylene glycol, 1, 4-butylene glycol, 1,6-hexanediol, neopentyl glycol, a diethylene glycol, dipropylene glycol, the bisphenol A ethyleneoxide addition product, and the bisphenol A propylene oxide addition product, — it can be prodigal and triol, such as a serine, trimethylol propane, and trimethylolethane, and those mixture can be illustrated. In this, neopentyl glycol, a TOCHIMECHI roll propane, the bisphenol A ethyleneoxide addition product, and the bisphenol A propylene oxide addition product are desirable.

[0120] As an alcoholic component more than trivalent, they are a sorbitol, 1, 2 and 3, 6-hexane tetrol, 1, 4-sorbitan, pentaerythritol, dipentaerythritol, tripentaerythritol, 1 and 2, 4-butane triol, 1 and 2, 5-pentanetriol, glycerol, isobutane triol, and 2-methyl. — 1, 2, 4-butane triol,

trimethylolethane, trimethylol propane, 1 and 3, 5-trihydroxy methylbenzene, etc. are mentioned. [0121] A polymerization can use a well-known polycondensation, solution polycondensation, etc. A good toner can be obtained without spoiling the color of the color material of vinyl chloride-proof mat nature or a color toner by this.

[0122] As for the operating rate of a multiple-valued carboxylic acid and polyhydric alcohol, 0.8-1.4 are usually common at a rate (OH/COOH) of the number of hydroxyl groups to the number of carboxyl groups.

[0123] Moreover, in this gestalt, a charge control agent is blended with binding resin for the purpose of charge control of a toner. As a desirable material, the metal complex of a salicylic-acid metal complex and a benzoic-acid derivative and phenyl borate quaternary ammonium salt are used suitably. Zinc, nickel, copper, and chromium are suitable for a metal. 0.5 - 5 weight section of an addition is desirable to the binding resin 100 weight section. It is 3 - 4 weight section preferably [ it is more desirable and ] to 1 - 4 weight section and a pan.

[0124] As a pigment used for this gestalt, carbon black, iron black, graphite, Nigrosine, the metal complex of azo dye, the C.I. pigment yellow 1, 3, 74, and 97, the acetoacetic-acid aryl amide system monoazo yellow pigment of 98 grades, C. I. pigment yellow 12, 13, and 14, the acetoacetic-acid aryl amide system JISUAZO yellow pigment of 17 grades, C. — I. solvent yellow 19, 77, and 79, C.I. De Dis Perth Yellow 164, the C.I. pigment red 48, 49:1, and 53, the red pigments of 1, 57, 57:1, 81 and 122, and 5 grades — C. I. solvent red 49, 52, and 58, the red color of 8 grades, the phthalocyanine of C.I. pig NENTO blue 15:3 grade, and the blue stain pigment of the derivative are blended by one sort or two kinds or more. 3 - 8 weight section of an addition is desirable to the binding resin 100 weight section.

[0125] Toner particle size is required more of diameter[ of a granule ]-izing, and more sharp particle-size-distribution-ization as a purpose of high-resolution-izing. Moreover, the relation between the particle size of a fixing assistant and the particle size of a toner added to a toner at this time has contributed to development nature, electrification nature, and filming nature. If a fixing assistant does not have the particle size in a fixed region to toner particle size, fault electrification occurs more notably, faults, such as toner condensation, an image concentration fall under damp, and photo conductor filming, do not arise, or offset-proof nature stops that is, acting effectively.

[0126] Therefore, it is necessary to set particle size distribution as the fixed set point. That is, when volume mean particle diameter of TP and a fixing assistant is set to FP for the volume mean particle diameter of a toner, FP/TP is 0.3 or more and is setting particle size as the range which fills 0.9 or less.

[0127] If it becomes smaller than 0.3, the offset-proof effect at the time of fixing will fall, and a non-offsetting temperature region will become narrow. If larger than 0.9, fault electrification will arise more notably and toner condensation and the image concentration fall under damp will arise.

[0128] Moreover, it is easy to carry out filming to a photo conductor with the load at the time of cleaning the non-imprinted toner which remains on a photo conductor at the time of an imprint, and comes to be. Moreover, contamination of a roller becomes severer in case a toner layer is formed in a thin layer on a developing roller. Moreover, by the fixing assistant desorbed from the toner becoming easy to remain in a non-imprinted toner in the waste toner recycle case, and returning this to development again, electrification is changed in a developer and that image quality is unmaintainable arises. Moreover, a toner carries out fault electrification by repetition use over a long period of time, and the fall of image concentration arises.

[0129] Furthermore, the volume mean particle diameter of a toner is 3-11 micrometers, and is 3-6 micrometers more preferably 3-9 micrometers. If larger than 11 micrometers, resolution will fall, if high definition is smaller than \*\*\*\*\* and 3 micrometers, condensation of a toner will become strong and ground fogging will increase.

[0130] The volume mean particle diameter of a fixing assistant is 1-10 micrometers, and is 2-5 micrometers more preferably 2-8 micrometers.

[0131] Moreover, it is desirable that the coefficient of variation of the volume particle size distribution of a toner is [ the coefficient of variation of 15 - 35% and number particle size

distribution ] 20 – 40%. For the coefficient of variation of number particle size distribution, the coefficient of variation of volume particle size distribution is [ the coefficient of variation of volume particle size distribution / the coefficient of variation of number particle size distribution ] 20 – 30% 15 to 25% still more preferably 20 to 35% 15 to 30% more preferably.

[0132] With coefficient of variation, the standard deviation in the particle size of a toner is broken by mean particle diameter. It carries out based on the particle diameter measured using the Coulter counter (coal tar company). Standard deviation is expressed with the square root of the value which divided the square of the difference from the average of each measured value when measuring n particle systems by (n-1).

[0133] That is, coefficient of variation is what carried out [ bubble ] breadth condition of particle size distribution, and the coefficient of variation of volume particle size distribution is productively difficult coefficient of variation, if the coefficient of variation of less than 15% or number particle size distribution becomes less than 20%, and it causes a cost rise. If the coefficient of variation of volume particle size distribution becomes [ the coefficient of variation of size or number particle size distribution ] larger than 40% from 35%, and particle size distribution serve as broadcloth, coherent [ of a toner ] will become strong and it will become easy to generate filming to a photo conductor.

[0134] When a toner is diameter[ of a granule ]-ized and distribution width of face is further made less than into constant value, in order to maintain a fluidity, it is necessary to add the plasticizer of a constant rate. Moreover, if the dispersibility in kneading is bad, a fluidity will also be affected, deterioration of image quality and waste toner recycle cannot be performed good, and imprint effectiveness falls, and formation of the uniform layer of the toner on a developing roller becomes difficult. Moreover, by the 2 component development method, miscibility with a carrier falls, it becomes unstable, electrification distribution becomes uneven, and toner concentration control causes deterioration of image quality. Therefore, the diameter[ of a granule ]-ized toner needs to add many silicas which can give a high fluidity.

[0135] Then, when a toner is diameter[ of a granule ]-ized and distribution width of face by coefficient of variation is made less than into constant value, a property can be more suitably stabilized to the diameter toner of a granule by the binding resin of this configuration, and the fixing assistant.

[0136] Moreover, by the development method which homogeneity is made to regulate and carry out frictional electrification of the thin layer of a toner with the rigid body or an elastic blade on a development roll, and develops an electrostatic latent image, a development sleeve and a blade are made to pollute, nonuniformity arises in the stratification of a toner, and an image defect may be caused.

[0137] With this gestalt, imprint material is made to insert in between image support and a conductive elastic roller, and it is used by giving imprint bias voltage to said conductive elastic roller suitable for the electrophotography equipment possessing the toner imprint system which imprints the toner image on said image support to imprint material by electrostatic force. Since this is a contact imprint, the toner which adhered to the photo conductor surface in the condition of the reversed-polarity toner adhering to the photo conductor surface on which mechanical power other than electric force acts on an imprint, and should be imprinted essentially, and out of which it does not come not being imprinted, or not \*\*\*\*(ing) pollutes the imprint roller surface, and it may make a transfer paper rear face, as for this toner imprint system, pollute [ toner ].

[0138] Then, while being able to prevent offset nature in fixing which does not use oil by use of the compound which has the fluorine of this gestalt, by the positive electrification nature silica and addition of low resistance metallic-oxide impalpable powder, condensation of a toner is suppressed, fault electrification is prevented, stabilization of electrification nature is obtained, and while being able to prevent the inside omission at the time of an imprint, it becomes that it is possible in obtaining high imprint effectiveness. Moreover, generating of filming to a middle imprint object and a photo conductor can be prevented, and contamination by the unnecessary toner particle of a transfer paper can be prevented. Moreover, since the toner to the imprint roller surface and filming of a silica which separated can also be prevented, the image defect



produced when a toner and the silica which separated re-imprint from the imprint roller surface to the photo conductor surface can also be prevented. A property can be more suitably stabilized to the diameter toner of a granule.

[0139] Moreover, with this gestalt, it is used suitable for the electrophotography equipment possessing the waste toner recycle system which collects in a developer the toners which remained on image support after the imprint process, and is again used for a development process. In order that a waste toner may reuse in development, the toner by which fault electrification was carried out more will return to development, and it becomes the phenomenon in which change electrification by continuation repetition use and image concentration falls. Moreover, since it is easy to carry out toner condensation, it lifting-comes to be easy of blinding with a duct.

[0140] Moreover, the compound which has the fluorine which separated in response to the mechanical shock inside the duct which connects a cleaning machine, a cleaning machine, and a development counter while being collected from the cleaning machine by the development counter, and the development counter will be omitted, or filming will be produced on a photo conductor.

[0141] Then, while being able to prevent offset nature in fixing which does not use oil by use of the compound which has the fluorine of this gestalt. Condensation of a toner is suppressed by the positive electrification nature silica and addition of low resistance metallic-oxide impalpable powder. Without starting blinding with a duct, fault electrification is prevented, even if stabilization of electrification nature is obtained and carries out continuation repeat use, also under low-humidity/temperature, it is stabilized and image concentration and fogging can be maintained, and it becomes possible to prevent filming on a photo conductor.

[0142] It is used suitable also for the 1 component developing-negatives method. The developing roller which consists of the feed roller, the silicon resin, or urethane resin which consists of urethane resin is contacted with the fixed amount (0.1-1mm) of interlocking, a toner is supplied to a developing roller from a feed roller, and it is used suitable for the developing-negatives method which carries out contact use of the doctor blade of rubber metallurgy group stainless steel of an elastic body, forms the thin layer of a toner, flows in one direction or impresses [ alternating current ] it in a photo conductor, contact, or non-contact, and forms a toner image on At this time, it is made to rotate in this direction and a feed roller and a developing roller consider peripheral speed of a developing roller and a feed roller as the configuration which carries out a developing roller early at a rate of 1:1 to 0.8:0.2. Moreover, the pressure welding of the developing roller is carried out to the photo conductor surface by the pressure of  $9.8 \times 10^2$  to  $9.8 \times 10^4$  (N/m<sup>2</sup>), and the electrostatic latent image on a photo conductor is developed. Moreover, the pressure welding of the elastic blade is carried out on a developing roller by the pressure of  $5 \times 10^3$  to  $5 \times 10^5$  (N/m<sup>2</sup>), and a toner layer is formed.

[0143] Furthermore, in order to control the amount of toner conveyances on the developing roller at the time of conveying the amount of supply of the toner supplied from a toner reservoir to up to a developing roller to a constant rate, the configuration which the feed roller of the shape of sponge which consists of urethane resin etc. is contacted to a developing roller, and possesses it is taken.

[0144] This is an effective means in order to regulate the amount of conveyances of a toner to a constant rate. However, although a part for a developing-roller round is developed by high concentration when the amount of conveyances of the toner on a developing roller falls during long-term continuous duty or a poor black image is taken, by the subsequent image, the solid imitation nature to which concentration falls rapidly, without conveying a toner may get worse on a developing roller. When the amount of electrifications of the toner on a developing roller was measured by the suction type, it turned out that the amount of electrifications is falling greatly. Therefore, although the cure which increases the quantity of a charge control agent or a silica, and raises the amount of electrifications was tried, image concentration became the direction to which it falls more at reverse. Moreover, in the toner which adds a fluorine content compound, the concentration fall arose more.

[0145] It is because the amount of electrifications of the toner of the feed roller section will

increase greatly if it furthermore pursues, that is, the amount of electrifications of a toner is not falling, the charge up of the fall of image concentration is carried out in the feed roller section before a developing roller is supplied and the serviceability from a feed roller to a developing roller declined. However, if a material presentation is changed so that electrification of a toner may be lowered, toner scattering of the development counter circumference will increase. Therefore, the configuration which can secure image concentration is needed, preventing scattering of a toner.

[0146] Then, while being able to prevent offset nature in fixing which does not use oil by use of the compound which has the fluorine of this gestalt, by the positive electrification nature silica and addition of low resistance metallic-oxide impalpable powder, condensation of a toner was suppressed, fault electrification was prevented, and stabilization of electrification nature was obtained, and even if it carried out continuation repeat use, it found out that image concentration and fogging could be stabilized and maintained also under low-humidity/temperature. This becomes possible [ suppressing toner scattering by containing a toner parent and the external additive of reverse electrification nature ] while suppressing fault electrification of the toner in a feed roller with the non-subtlety powder which has a positive electrification nature silica or low resistance. Furthermore the image concentration at the time of continuous duty can be stabilized, and poor imitation nature will also become good.

[0147] Moreover, it becomes easy to generate welding heat condensation of a toner by \*\*\*\*\* between a feed roller and a developing roller. Moreover, it produces and cheats out of a blemish on a developing roller, and it serves as an image noise and appears. Moreover, if the electrification nature of a toner is changed during long-term use, supply of the toner from a feed roller to a developing roller will become unstable, and an image concentration fall and fogging will be produced. Moreover, with a silicon resin roller, if in contact with the photo conductor, the impurity of silicone resin will adhere to a photo conductor, it will become photo conductor contamination, and a vertical reinforcement will be generated. Moreover, with the roller which used urethane resin, it becomes the cause of reducing the electrification nature of a toner low melting point materials, such as a wax, tending to adhere. The fixing assistant of a toner welds also to an elastic body blade, and a vertical reinforcement occurs in a toner layer.

[0148] Then, while being able to prevent offset nature in fixing which does not use oil by use of the compound which has the fluorine of this gestalt, by the positive electrification nature silica and addition of low resistance metallic-oxide impalpable powder, condensation of a toner is suppressed and neither condensation nor welding is produced. Moreover, since homogeneity distribution of the compound which has a fluorine is carried out in a toner, stabilization of electrification is attained, and stabilization of an image can be attained, even if there is little generating of fogging and it uses it over a long period of time.

[0149] Moreover, multiple-times repeat activation of the primary imprint process of making the surface of an endless-like middle imprint object the toner image formed in the surface of image support contacting the surface of said image support, and making the surface concerned imprinting said toner image is carried out. Then, it is used suitable for the electrophotography equipment possessing the imprint system constituted so that the secondary imprint process of making imprint material carrying out the package imprint of the duplication imprint toner image formed in the surface of said middle imprint object of repeat activation of the multiple times of this primary imprint process might be performed. At this time, the pressure welding of a photo conductor and the middle imprint object is carried out by the pressure of  $9.8 \times 10^2$  to  $2 \times 10^5$  (N/m<sup>2</sup>), and the toner on a photo conductor is imprinted. Moreover, as for the toner image formed in the middle imprint body surface, an imprint member presses the surface of a middle imprint object through the recording paper by  $5 \times 10^3$  to  $2 \times 10^5$  (N/m<sup>2</sup>) pressure, and a toner is imprinted on record material.

[0150] Then, while being able to prevent offset nature in fixing which does not use oil by use of the compound which has the fluorine of this gestalt, by the positive electrification nature silica and addition of low resistance metallic-oxide impalpable powder, condensation of a toner is suppressed, fault electrification is prevented, stabilization of electrification nature is obtained, and while being able to prevent the inside omission at the time of an imprint, it becomes that it is

possible in obtaining high imprint effectiveness. Moreover, generating of filming to a middle imprint object and a photo conductor can be prevented, and contamination by the unnecessary toner particle of a transfer paper can be prevented. Moreover, since the toner to the imprint roller surface and filming of a silica which separated can also be prevented, the image defect produced when a toner and the silica which separated re-imprint from the imprint roller surface to the photo conductor surface can also be prevented. A property can be more suitably stabilized to the diameter toner of a granule.

[0151] Moreover, it consists of image formation unit groups which have arranged two or more movable image formation units which form the toner image of a color which was equipped with a development means to have the toner with which a color differs from the rotating photo conductor, respectively, and is different on said photo conductor, respectively in the shape of a circular ring. The whole image formation unit group is rotated and it is used suitable for the color electrophotography equipment which imprints in piles the toner image of a different color formed on the photo conductor, doubling a location on imprint material, and forms a color image. Since it is the configuration which the whole image formation unit rotates, it is cleaned from a photo conductor and the condition the waste toner which is distant from on a photo conductor carries out [ a condition ] repeat adhesion temporarily to a photo conductor again surely occurs. It becomes easy to generate filming to image support because the waste toner carries out repeat contact again with a photo conductor remarkably, and becomes the factor of a life fall of a photo conductor.

[0152] Moreover, when an image formation unit rotates, in order that a toner may move violently up and down, it is easy to generate \*\*\*\*\* of the toner from a seal portion, therefore it is necessary to strengthen a seal with a seal portion more, and a welding phenomenon occurs, and it serves as a lump and causes an image noise of a black line and a white muscle.

[0153] Moreover, the condition of always seceding from a developing roller temporarily occurs, and if the standup nature of a toner of electrification is bad in the early stages of development, it will cause ground fogging. It is in the orientation for electrification standup nature to get worse, in the toner in which the wax with which the maldistribution was unevenly distributed existed.

[0154] Then, while being able to prevent offset nature in fixing which does not use oil by use of the compound which has the fluorine of this gestalt, by the positive electrification nature silica and addition of low resistance metallic-oxide impalpable powder, condensation of a toner is suppressed, fault electrification is prevented, stabilization of electrification nature is obtained, and the start of electrification can be done early, and fault electrification under low-humidity/temperature can be prevented, and there is nothing in generating of ground fogging in early stages of development. Generating of filming and generating of welding can be prevented and it becomes possible to acquire the development property stabilized over a long period of time.

[0155] A toner is created through the production process of preliminary mixing processing, melting kneading processing, grinding classification processing, and outside \*\*\*\*\*.

[0156] Preliminary mixing processing is processing which carries out homogeneity distribution of binding resin and the additive which this should be made to distribute with the mixer possessing an impeller etc. As a mixer, a mixer with well-known super mixer (made in the Kawada factory), Henschel mixer (product made from the Mitsui Miike industry), PS mixer (Shinko Pantec make), rhe DIGE mixer, etc. is used.

[0157] And thermofusion kneading is performed by PCM30 (IKEGAI), coarse grinding of the obtained toner lump is carried out by a cutter mill etc., he is finely ground after that by jet mill grinding (for example, an IDS grinder, Japanese pneumatic industry) etc., a fines particle is further cut with an air-current type classifier if needed, and the toner particle (toner parent particle) of desired particle size distribution is obtained. Grinding by the mechanical cable type and a classification are also possible, and a KURIPU TRON grinder (Kawasaki Heavy Industries), a turbo mill (turbo industry), etc. which throw in and grind a toner to a minute opening with the roller which rotates to the fixed stator, for example are used for this. Income of the toner particle (toner parent particle) which has the volume mean particle diameter of the range of 3-6 micrometers by this classification processing is carried out.

[0158] Outside \*\*\*\*\* is processing which mixes external additives, such as a silica, to the toner particle (toner parent particle) obtained by said classification. A mixer with well-known Henschel mixer, super mixer, etc. is used for this.

[0159] Next, an example explains this invention to details further.

[0160] The property of the binding resin used in the example is shown in (a table 1). Resin used the polyester resin which used the bisphenol A propyl oxide addition product, a terephthalic acid, trimellitic acid, and a succinic acid as the principal component, and used the resin into which the heat characteristic was changed according to a compounding ratio and polymerization conditions. AV shows the acid number of resin.

[0161]

[A table 1]

樹脂	PES-1	PES-2	PES-3
Mnf ( $\times 10^4$ )	0.32	0.32	0.34
Mwf ( $\times 10^4$ )	6.40	10.20	5.70
Mzf ( $\times 10^4$ )	97.50	302.50	40.50
Wmf=Mwf/Mnf	20.00	31.88	16.76
Wzf=Mzf/Mnf	304.69	945.31	119.12
Tg	58.00	61.00	55.50
Tm	115.00	118.00	109.00
Ti	100.00	101.00	95.00
AV	15	20	25

[0162] Mnf — the number average molecular weight of binding resin, and Mwf — the weight average molecular weight of binding resin, and Wmf — the ratio of weight average molecular weight Mwf and number average molecular weight Mnf —  $Mwf/Mnf$  and Wzf — the ratio of the Z average molecular weight Mzf and number average molecular weight Mnf of binding resin —  $Mzf/Mnf$  is shown.

[0163] The property of the hydrophobic silica used in the example is shown in (a table 2).

[0164]

[A table 2]

疎水性 シリカ	材料	BET値 ( $m^2/g$ )	帯電量 (5分値) ( $\mu C/g$ )	帯電量 (30分値) ( $\mu C/g$ )
SG1	アミノ変性シリコンオイルで 処理されたシリカ	140	308	193
SG2	末端にシラノール基を持たせた ジメチルシリコンオイル で処理されたシリカ	200	-480	-360
SG3	ジメチルシリコンオイル で処理されたシリカ	80	-430	-155

[0165] The property of the low resistance metallic-oxide particle used in the example and metal acid chloride system impalpable powder is shown in (a table 3).

[0166]

[A table 3]

第2外添剤	材料	平均粒径 ( $\mu\text{m}$ )	BET値 ( $\text{m}^2/\text{g}$ )
G-1	水熱合成法により作成された チタン酸バリウム	0.2	5.04
G-2	シュウ酸塩熱分解法により作成された ジルコン酸ストロンチウム	0.67	2.63
G-3	酸化チタン	0.2	6.5
G-4	酸化インジウム	0.1	10.5
G-5	酸化錫－アンチモンで表面被覆 処理された酸化シリカ	0.04	83.2

[0167] The fluorine content compound (fixing assistant) used in the example and its differential scanning calorimetry (DSC property) are shown in (a table 4). The intersection of the tangent of the start curve at the time of the endothermic initiation at the time of a temperature up and the tangent of the curve which tends toward the peak after starting is made into tangent melting point temperature.

[0168]

[A table 4]

定着 助剤		粒径 ( $\mu\text{m}$ )	比重 ( $\text{g}/\text{cm}^3$ )	接線融 点温度 ( $^{\circ}\text{C}$ )	ピーク 温度 ( $^{\circ}\text{C}$ )	融点温 度の差 (K)
W-1	ポリテトラフルオロエチレン とポリエチレンの共重合体	4	1.08	118	125.8	7.8
W-2	ホホバ油にフッ素極度添加	5.5	1.15	97.3	113	15.7
W-3	ポリテトラフルオロエチレン と、C16の長鎖アルキル基 有するアクリル酸エステル の共重合体	6	1.2	127	135	8
W-4	ポリテトラフルオロエチレン とポリエチレンの共重合体	8	1.01	68.7	100.9	32.2

[0169] The toner material presentation used by this example is shown in (a table 5). 20 to 25%, the coefficient of variation of 3–6 micrometers and volume particle size distribution made the weighted mean particle size of each toner as an experiment so that the coefficient of variation of number particle size distribution might become 25 – 30%.

[0170]

[A table 5]

トナー	結着樹脂	電荷制御剤	定着助剤	顔料	外添剤		
TM1	PES1	E84(3)	W1(6)	マゼンタ顔料(5)	SG1(1)		
TM2	PES2	↑	W2(4)	↑	SG1(0.8)	SG2(0.3)	
TM3	PES3	↑	W3(8)	↑	SG1(0.6)		G1(1)
TM4	PES3	↑	W1(6)	↑	SG1(0.6)		G3(1.2)
TM5	PES3	↑	W4(6)	↑		SG3(0.3)	
TY1	PES1	↑	W1(6)	イエロー顔料(5)	SG1(1)		
TY2	PES2	↑	W2(4)	↑	SG1(0.8)	SG3(0.3)	G5(1)
TY3	PES3	↑	W3(8)	↑	SG1(0.6)		G4(1.5)
TY4	PES3	↑	W1(6)	↑	SG1(0.6)		G3(2)
TY5	PES3	↑	W4(6)	↑		SG3(0.3)	
TC1	PES1	↑	W1(6)	シアン顔料(5)	SG1(1)		
TC2	PES2	↑	W2(4)	↑	SG1(0.8)	SG3(0.3)	
TC3	PES3	↑	W3(8)	↑	SG13(0.6)		G2(1)
TB1	PES1	↑	W1(6)	CB(5)	SG1(1)		
TB2	PES2	↑	W2(4)	↑	SG1(0.8)		G2(1)
TB3	PES3	↑	W3(8)	↑	SG1(0.6)	SG2(0.3)	
TB4	PES3	↑	W4(6)	↑		SG2(0.3)	

[0171] a pigment — respectively — every color — black — carbon black (CB) — in the Magenta pigment, the yellow pigment used the C.I. pigment yellow 180, and the cyanogen pigment used the phthalocyanine of the C.I. pig NENTO blue 15:3 for the C.I. pigment red 57:1. A charge control agent uses the ORIENT chemistry company make E84 (salicylic-acid zinc metal complex compound), and a loadings ratio shows the loadings (weight section) ratio to the binding resin 100 weight section in a parenthesis. A silica, a low resistance metallic-oxide particle, and metal acid chloride system impalpable powder show the loadings (weight section) to the toner parent 100 weight section.

[0172] Outside \*\*\*\*\* was performed by 1kg of inputs in FM20B for impeller ZOS0 mold, rotational frequency 2000min<sup>-1</sup>, and processing-time 5 minutes.

[0173] (Example 1) Drawing 1 is the cross section showing the configuration of the electrophotography equipment used by this example. This example equipment is the configuration which converted FP7750 (Matsushita Electric Co., Ltd. make) copying machine into reversal development, and added the waste toner recycle device.

[0174] 301 is an organic photo conductor and is the thing of a configuration of having carried out the laminating of the charge transportation layer which forms a charge generating layer for the powder of an oxo-titanium phthalocyanine by vacuum evaporatio on the conductive base material of aluminum, and contains the mixture of polycarbonate resin (Mitsubishi Gas Chemical make Z-200), and a butadiene and a hydrazone on it one by one.

[0175] The corona-electrical-charging machine with which 302 is charged in minus in a photo conductor, the grid electrode with which 303 controls the electrification potential of a photo conductor, and 304 are signal light. For a development sleeve and 306, as for the magnet roll for carrier maintenance, and 308, a doctor blade and 307 are [ 305 / a carrier and 309 ] toners. The carrier blended methyl silicone resin, phenyl silicone resin, and butyl acrylate by 2:6:2, and they carried out the coat to the surface of a Mn-Mg ferrite particle. The volume resistivity of mean particle diameter is 10<sup>12</sup>-ohmcm in 40-60 micrometers. The toner used TB-1 indicated to a table 5, and 2 and 3.

[0176] It is a duct for the waste toner of the imprint remainder and 312 to return 310 for a voltage generator and 311 to a cleaning box, and for 313 return the waste toner 311 in the cleaning box 312 to a development production process. It is failed to write the toner of the

imprint remainder with a cleaning blade 314, and the waste toner 311 which was able to be temporarily collected in the cleaning box 312 is constituted so that it may be returned to a development production process by the duct 313.

[0177] 314 is the imprint roller which imprints the toner image on a photo conductor on paper, and it is set up so that the surface may contact the surface of a photo conductor 301. The imprint roller 314 is an elastic roller which prepared the conductive elastic member in the perimeter of the shaft which consists of a conductive metal. the thrust to a photo conductor 301 — per [ imprint roller 314 1 (about 216mm) / 0 ] —  $1.96 \times 10^5 \text{ N/m}^2$  — it is  $4.9 \times 10^3$  to  $9.8 \times 10^4 \text{ N/m}^2$  desirably. This was shrunken with the spring coefficient of the spring for carrying out the pressure welding of the imprint roller 314 to a photo conductor 301, and was measured from the product of an amount.

[0178] The contact width of face with a photo conductor 301 is about 0.5mm – 5mm. By the measuring method (measurement using not roller geometry but a block piece) of ASUKA C, the rubber degree of hardness of the imprint roller 314 is 80 or less degrees, and is 30 – 70 degrees desirably. If smaller than 30 degrees, imprint effectiveness will fall and the amount of waste toners will increase. If larger than 70 degrees, it will become easy to produce an omission during an imprint. For a \*\* reason, also in order to fully demonstrate the effect, the above-mentioned range is required of the toner which can be distributing the inner \*\*.agent of this configuration. to homogeneity.

[0179] The elastic roller 314 is resistance about inner-\*\*(ing) lithium salt, such as Li2O, around a shaft with a diameter of 6mm 107 The urethane elastomer of the fizz set to omega (an electrode is prepared in a shaft and the surface and impressed by both 500V) was used. As for resistance, it is desirable that it is in the range of 105–109ohm. If smaller than 105, imprint effectiveness will fall and the amount of waste toners will increase. If larger than 109, it will become easy to produce an omission during an imprint. For a \*\* reason, also in order to fully demonstrate the effect, the above-mentioned range is required of the toner which can be distributing the inner \*\* agent of this configuration to homogeneity.

[0180] The outer diameter of the imprint roller 213 whole was 16.4mm, and the degree of hardness was 40 degrees in ASUKA C. The imprint roller 314 was contacted to the photo conductor 301 by pressing the shaft of the imprint roller 314 with a metal spring. Thrust was abbreviation  $9.8 \times 10^4 \text{ N/m}^2$ . The elastic body which consists of other materials, such as CR rubber, NBR, Si rubber, and a fluororubber, besides the elastomer of the urethane of said fizz as an elastic body of a roller can also be used. And as a conductive grant agent for giving conductivity, other conductive material other than said lithium salt, such as carbon black, can also be used.

[0181] The inrush guide which consists of a conductive member to which 315 introduces a transfer paper into the imprint roller 314, and 316 are the conveyance guides which carried out pre-insulation of the surface of a conductive member. The inrush guide 315 and the conveyance guide 316 are grounded through direct or resistance. It is the voltage generating power supply in which carries out 317 at a transfer paper and 318 carries out voltage impression at the imprint roller 314.

[0182] The result of having performed the image test is shown in (a table 6).

[0183]

[A table 6]

トナー	感光体上 フィルミング	画像濃度(ID)		カブリ	高湿下 放置での カブリ	低湿下のID	
		初期	10万枚後			初期	1千枚後
TB-1	未発生	1.33	1.32	○	○	1.30	1.29
TB-2	未発生	1.34	1.32	○	○	1.32	1.30
TB-3	未発生	1.32	1.32	○	○	1.30	1.30
TB-4	発生	1.42	1.22	×	×	1.38	1.10

[0184] Image evaluation was evaluated to the image concentration and the ground fogging after a torture test 100,000 sheets after [ the early stages of image formation, and ]. The ground fogging was judged in clear vision, and when it was level which is satisfactory practically, it was considered as success (O).

[0185] Then, it was left under highly humid, the image test of one omasum was performed, and the increment in fogging was seen. Since fogging would increase rapidly if toner concentration control becomes poor and becomes an exaggerated toner, the condition was observed. Furthermore, it is left under elevated-temperature damp in another experiment overnight, the image test of the Japanese 5 following omasums is performed, and the image concentration after 5 omasums is shown.

[0186] There were not turbulence of striping, spilling of a toner, and soiling on the back of paper of a poor imprint and paper, there was no inside omission of an alphabetic character etc., the solid black image was uniform and the with an image concentration of 1.3 or more high-concentration image was obtained. The ground fogging in the non-image section was not generated, either. Furthermore, when the long-term copy test of 100,000 sheets was performed, the copy image of the high concentration which does not have filming on the photo conductor surface and is equal compared with an early image, and lowlands fogging was obtained. Moreover, there is no generating of fogging under highly humid, and the concentration fall was not generated under elevated-temperature damp.

[0187] Fixable evaluation of the rate of fixing in the elevated-temperature offset nature and the high-speed machine (450 mm/s) in a low-speed machine (140mm/s in process speed) was performed to (a table 7). Observing the condensation condition of the toner after 50-degree-C 24-hour neglect by the storage stability test, problem nothing and x are practically problematic level without condensation in O practically.

[0188]

[A table 7]

トナーサンプル	高温オフセット	定着率
TB-1	200℃まで未発生	86%
TB-2	200℃まで未発生	84%
TB-3	210℃まで未発生	88%
TB-4	175℃まで未発生	84%

[0189] With regards to process speed, the peripheral velocity of a photo conductor is shown in the copy throughput per time amount of a machine. The bearer rate of a copying paper is decided by peripheral velocity of a photo conductor.

[0190] The copying paper of 80 g/m<sup>2</sup> paper (Igepa) was used, and the rate of fixing scraped 10 \*\*\*\*s of the patches of image concentration 1.0\*\*0.2 for every train with the 500g (phi36mm) weight around which BEMCOT (trademark by Asahi Chemical Co., Ltd.) was wound, measured the image concentration before and behind a scratch with the Macbeth reflection density plan, and defined it by the rate of change.

[0191] In the rate of fixing, offset nature made 180 degrees C or more success level 80% or more.

[0192] The elevated-temperature offset nature in a low speed and the rate of fixing in high speed were able to show the good property, and were able to share-ize the high-speed machine and the low-speed machine with one toner.

[0193] (Example 2) Drawing 2 is the cross section showing the configuration of the electrophotography equipment for full color image formation used by this example. In drawing 2, 1 is \*\*\*\*\* of a color electro photographic printer, and the right end-face side in drawing is a front face. 1A is a front-face board of a printer, and this front board 1A is lifting closing actuation freedom like derrick-down aperture actuation and a continuous line display to printer



\*\*\*\*\* 1 like a dotted line display centering on hinge shaft 1B by the side of the lower side. The printer interior check maintenance at the time of attachment-and-detachment actuation and the paper jam of the middle imprint belt unit [ / in a printer ] 2 etc. is performed by pushing down and opening front board 1A and releasing the interior of a printer greatly. Attachment-and-detachment actuation of this middle imprint belt unit 2 is designed so that it may become perpendicularly to the direction of an axis-of-rotation bus-bar of a photo conductor.

[0194] The configuration of the middle imprint belt unit 2 is shown in drawing 3. The middle imprint belt unit 2 to unit housing 2a The middle imprint belt 3, the 1st imprint roller 4 which consists of a conductive elastic body, the 2nd imprint roller 5 which consists of an aluminum roller, the tension roller 6 which adjusts the tension of the middle imprint belt 3, the belt-cleaner roller 7 which cleans the toner image which remained on the middle imprint belt 3, The scraper 8 which fails to write the toner collected on the cleaner roller 7, and the position transducer 10 which detects the location of the \*\*\*\*\* waste toner reservoirs 9a and 9b and the middle imprint belt 3 for the collected toner are connoted. Front-face board of printer 1A can be pushed down like a dotted line, this middle imprint belt unit 2 can open it, and it can detach and attach freely to the predetermined stowage in printer \*\*\*\*\* 1 as shown in drawing 2.

[0195] Into insulating resin, the middle imprint belt 3 kneads a conductive filler, and with an extruder, it is film-ized and is used for it. In this example, what added and film-ized the conductive carbon (for example, KETCHIEN black) 5 weight section as insulating resin in the polycarbonate resin (for example, Mitsubishi Gas Chemical make, you pyrone Z300) 95 weight section was used. Moreover, the coat of the fluororesin was carried out to the surface. The thickness of a film is about 350 micrometers and resistance is about 107 to 109 ohm-cm. What kneaded the conductive filler to polycarbonate resin as a middle imprint belt 3, and film-ized this here is used because the slack by long-term use of the middle imprint belt 3 and are recording of a charge can be prevented effectively, and the coat of the surface is carried out with fluororesin, because toner filming to the middle imprint belt surface by long-term use can be prevented effectively.

[0196] This middle imprint belt 3 is consisted of a film which used the urethane of half-conductivity of the shape of an endless belt with a thickness of 100 micrometers as the base material, and it constitutes movable in winding and the direction of an arrow head in the 1st imprint roller 4, the 2nd imprint roller 5, and tension roller 6 which fabricated the urethane foam which carried out low resistance processing so that it might have resistance of 106 - 108 ohm-cm around. length (62mm) a little with the perimeter of the middle imprint belt 3 longer here than the one half of the perimeter of the photo conductor drum (diameter of 30mm) later mentioned to the length (298mm) of the longitudinal direction of A4 form which is the maximum paper size - a leg - it is set as 360mm the bottom.

[0197] When the main part of a printer is equipped with the middle imprint belt unit 2 The pressure welding of the 1st imprint roller 4 is carried out to a photo conductor 11 (it illustrates to drawing 3) by the force of about  $9.8 \times 10^4$  (N/m<sup>2</sup>) through the middle imprint belt 3. Moreover, the 2nd imprint roller 5 A pressure welding is carried out to the above-mentioned 1st imprint roller 4 and the 3rd imprint roller 12 (it illustrates to drawing 3) of the same configuration through the middle imprint belt 3. this 3rd imprint roller 12 — the middle imprint belt 3 — a follower — it constitutes pivotable.

[0198] The cleaner roller 7 is a roller of the belt-cleaner section which cleans the middle imprint belt 3. This is the configuration of impressing the alternating voltage which attracts a toner electrostatic to a metallic roller. In addition, this cleaner roller 7 may be the conductive fur brush which impressed a rubber blade and voltage.

[0199] In drawing 2, image formation unit 17Bk which carried out black, cyanogen, a Magenta, and 4 sets of fanning for each colors of Hierro in the center of a printer, and 17Y, 17M and 17C constitute the image formation unit group 18, and as shown in drawing, they are arranged in the shape of a circular ring. each — image formation unit 17Bk, and 17Y, 17M and 17C can open printer upper surface board 1C focusing on hinge shaft 1D, and it can be freely detached and attached to the position of the image formation unit group 18. By being equipped in a printer at normal, the mechanical drive network and electrical circuit network by the side of both by the

side of an image formation unit and a printer join together through a mutual coupling member (un-illustrating), and unifies mechanically and electrically image formation unit 17Bk, and 17Y, 17M and 17C.

[0200] Image formation unit 17Bk arranged in the shape of a circular ring, and 17C, 17M and 17Y are supported by the base material (not shown), are driven on the migration motor 19 which is a migration means as a whole, and are constituted possible [ a rotation ] around the cylinder-like shaft 20 which is fixed and does not rotate. Each image formation unit can be located in the image formation location 21 which counteracted the 2nd imprint roller 4 which supports the middle imprint belt 3 of the sequential above-mentioned by rotation. The image formation location 21 is also an exposure location by the signal light 22.

[0201] each — since image formation unit 17Bk, and 17C, 17M and 17Y consist of the respectively same configuration member except for the developer put into inside, they explain image formation unit 17Bk for black in order to simplify explanation, and omit about explanation of the unit for other colors.

[0202] 35 is the laser beam scanner section arranged in the bottom in printer \*\*\*\*\* 1, and consists of the semiconductor laser which is not illustrated, scanner motor 35a, polygon mirror 35b, lens system 35c, etc. The pixel laser signal light 22 corresponding to the time series electrical-and-electric-equipment pixel signal of the image information from this laser beam scanner section 35 It passes along the optical-path window 36 formed between image formation unit 17Bk and 17Y. Incidence is carried out to the mirror 38 to which it was fixed within the shaft 20 through the aperture 37 which was able to be opened in some shafts 20. It advances almost horizontally in image formation unit 17Bk from the exposure aperture 25 of image formation unit 17Bk which is reflected and is in the image formation location 21. Incidence is carried out to the exposure section of the left lateral of a photo conductor 11 through the path between the developer reservoirs 26 and cleaners 34 which are arranged up and down in the image formation unit, and scan exposure is carried out in the direction of a bus-bar.

[0203] Since the optical path from the optical-path window 36 to a mirror 38 uses the crevice between the units of neighboring image formation unit 17Bk(s) and 17Y, there is almost no space which becomes useless in the image formation unit group 18 here. Moreover, since the mirror 38 is formed in the center section of the image formation unit group 18, it can be constituted from a fixed single mirror and is a configuration with simply easy alignment etc.

[0204] 12 is the 3rd imprint roller arranged above the paper feed roller 39 by the inside of front-face board of printer 1A, and the form conveyance way is formed in the nip section of the middle imprint belt 3 and the 3rd imprint roller 12 by which the pressure welding was carried out so that a form may be sent with the paper feed roller 39 formed in the lower part of front-face board of printer 1A.

[0205] 40 is the sheet paper cassette which the method of outside was made to project and was prepared in the lower side side of front-face board of printer 1A, and can set two or more papers S to coincidence. The paper discharge roller pair to which 41a and 41b arranged in the paper outlet side of fixing roller pair 42a and 42b a paper conveyance timing roller, the fixing roller pair by which 42a and 42b were prepared in the inside upper part of a printer, the paper guide plate which prepared 43 between the 3rd imprint roller 12, and fixing roller pair 42a and 42b, and 44a and 44b, and 47 are the cleaning rollers of fixing roller 42a.

[0206] A fixing assembly serves as a heating roller which consists of the hollow roller and elastic layer which consist of the aluminum or stainless steel RENSU which has a heating means inside, and a fluororesin tube from a pressurization roller. The fluororesin tube of the outermost layer has the desirable tube with which thickness is chosen from the copolymer of 1–100 micrometers, polytetrafluoroethylene, tetrafluoroethylene, and perfluoroalkyl vinyl ether, or the copolymer of tetrafluoroethylene and hexafluoro ethylene. An elastic layer has silicone rubber, a fluororubber, a fluorosilicone rubber, and desirable ethylene propylene rubber. The rubber degree of hardness by JIS is 10 – 70 degrees, and the degree of hardness of an elastic layer is pressurized by the pressure of  $4.9 \times 10^4 - 1.96 \times 10^6$  N/m<sup>2</sup> with a pressurization roller. In this example, the fluororesin tube and rubber degree of hardness of polytetrafluoroethylene whose thickness is 50 micrometers consist of silicone rubber 70 degrees, and are pressurized by the pressure of

1.47x10<sup>4</sup> N/m<sup>2</sup>. Fixing oil, such as silicone oil, is not using it.

[0207] each — the waste toner reservoir is prepared in image formation unit 17Bk, 17C, 17M and 17Y, and the middle imprint belt unit 2.

[0208] Hereafter, actuation is explained.

[0209] At first, the image formation unit group 18 has black image formation unit 17Bk in the image formation location 21, as shown in drawing 2. At this time, the photo conductor 11 is carrying out opposite contact through the middle imprint belt 3 at the 1st imprint roller 4.

[0210] A black signal light is inputted into image formation unit 17Bk by the laser beam scanner section 35 according to an image formation production process, and image formation by the black toner is performed. At this time, the speed (60 mm/s equal to the peripheral speed of a photo conductor) of the image formation of image formation unit 17Bk and the passing speed of the middle imprint belt 3 are set up so that it may become the same, it is an operation of the 1st imprint roller 4, and a black toner image is imprinted by the middle imprint belt 3 at image formation and coincidence. At this time, the direct current voltage of +1kV was impressed to the 1st imprint roller. Immediately after all black toner images finish imprinting, the whole drives image formation unit 17Bk, and 17C, 17M and 17Y on the migration motor 19 as an image formation unit group 18, they rotate in the direction of an arrow head in drawing, and stop at the location where it rotated 90 degrees exactly and image formation unit 17C arrived at the image formation location 21. Since the portions of toner hoppers 26 other than the photo conductor of an image formation unit or a cleaner 34 are located inside the rotation circle at photo conductor 11 tip in the meantime, the middle imprint belt 3 does not contact an image formation unit.

[0211] Like the front after image formation unit 17C's arriving at the image formation location 21, shortly, the laser beam scanner section 35 inputs the signal light 22 into image formation unit 17C by the signal of cyanogen, and formation and an imprint of cyanogen of a toner image are performed. By this time, the middle imprint belt 3 will make one revolution, and the write-in timing of the signal light of cyanogen is controlled so that the toner image of the following cyanogen agrees in location in the toner image of the black imprinted before. In the meantime, the 3rd imprint roller 12 and the cleaner roller 7 have separated a few from the middle imprint belt 3, and they are constituted so that the toner image on an imprint belt may not be disturbed.

[0212] It carried out also about a Magenta and Hierro, the toner image of four colors agreed in location on the middle imprint belt 3, the same actuation as the above was repeated, and the color image was formed. The package imprint of the toner image of four colors is carried out in an operation of the 3rd imprint roller 12 after the imprint of the last Hierro toner image at the form which doubles timing and is sent from a sheet paper cassette 40. At this time, the 2nd imprint roller 5 was grounded and impressed the direct current voltage of +1.5kV to the 3rd imprint roller 12. Fixing roller pair 42a and 42b were fixed to the toner image imprinted by the form. The form was discharged out of equipment through discharge roller pair 44a and 44b after that. The toner of the imprint remainder which remained on the middle imprint belt 3 was cleaned in the operation of the cleaner roller 7, and the next image formation was equipped with it.

[0213] Next, the actuation at the time of monochrome mode is explained. The image formation unit of a predetermined color moves to the image formation location 21 first at the time of monochrome mode. Next, the image formation of a predetermined color and the imprint to the middle imprint belt 3 were performed like the front, and it imprinted in the form shortly sent from a sheet paper cassette 40 with the following 3rd imprint roller 12 continuing as it is after an imprint, and was established as it is.

[0214] In addition, with this equipment, the image formation unit of structure using the developing-negatives method conventional as structure of an image formation unit can also be used.

[0215] The result of having performed image \*\*\*\* is shown in (a table 8) with the electrophotography equipment of drawing 2.

[0216]

[A table 8]

トナー	感光体上 フィルミング	画像濃度(ID)		カブリ	高温下 放置後 カブリ	低温低温下のID		転写中 抜け
		初期	テスト後			初期	5千枚後	
TM1	未発生	1.44	1.39	○	○	1.40	1.34	なし
TM2	未発生	1.40	1.36	○	○	1.36	1.33	なし
TM3	未発生	1.38	1.34	○	○	1.35	1.32	なし
TM4	未発生	1.42	1.40	○	○	1.39	1.34	なし
TM5	発生	1.46	1.18	×	×	1.44	1.10	発生
TY1	未発生	1.38	1.34	○	○	1.36	1.34	なし
TY2	未発生	1.40	1.37	○	○	1.38	1.36	なし
TY3	未発生	1.40	1.38	○	○	1.38	1.37	なし
TY4	未発生	1.44	1.40	○	○	1.40	1.36	なし
TY5	発生	1.48	1.20	×	×	1.43	1.14	発生
TC1	未発生	1.42	1.38	○	○	1.38	1.36	なし
TC2	未発生	1.36	1.33	○	○	1.34	1.32	なし
TC3	未発生	1.39	1.36	○	○	1.38	1.35	なし
TB1	未発生	1.40	1.37	○	○	1.34	1.31	なし
TB2	未発生	1.38	1.34	○	○	1.32	1.30	なし
TB3	未発生	1.42	1.38	○	○	1.34	1.32	なし
TB4	発生	1.42	1.22	×	×	1.40	1.16	発生

[0217] When this electrophotography equipment performed image \*\*\*\* using the toner manufactured as mentioned above, there are not turbulence of striping, spilling of a toner, an inside omission of an alphabetic character, etc., the solid black image was uniform, the image also reproducing 16 streaks/mm of very high resolution high definition was obtained, and the with an image concentration of 1.3 or more high-concentration image was obtained. Moreover, the ground fogging of the non-image section was not generated, either. Furthermore, also in the long-term torture test of 10,000 sheets, the fluidity and the property in which change was stabilized by image concentration few were shown. Moreover, also in the imprint, the inside omission was level which is satisfactory practically, and imprint effectiveness was 90%. Moreover, filming of the toner to a photo conductor and a middle imprint belt was also the level which is satisfactory practically. However, the omission occurred during filming of a photo conductor, or an imprint, and the toner of TM-5, TY-5, and TB-4 also generated many fogging.

[0218] Next (table 9), the offset nature in an elevated temperature was estimated as the permeability when fixing a two or more coating weight 0.4 g/cm solid image to an OHP form by the fixing assembly which does not apply oil at 170 degrees C. Process speed was 100 mm/s, and permeability is a spectrophotometer U-3200 (Hitachi), and measured the permeability of 700nm light. The result of fixable, offset-proof nature, and conservation stability is shown.

[0219]

[A table 9]

トナー	透過率 (%)	オフセット未発生温度域 (℃)	貯蔵安定性テスト
TM1	88.5	130-200	○
TM2	86	130-200	○
TM3	90.2	130-210	○
TM4	87.2	140-200	○
TM5	88	130-170	×
TY1	89.5	130-200	○
TY2	87.2	130-190	○
TY3	90.5	130-205	○
TY4	88.9	130-200	○
TY5	86.4	130-180	×
TC1	88.4	130-210	○
TC2	84.6	130-200	○
TC3	90.8	130-210	○

[0220] Fixable [ good ] was shown in the fixing roller with which OHP translucency shows 80% or more, and non-offsetting temperature width of face does not use 40-60K, and oil, either. Moreover, most condensation was not seen in 50 degrees C and the conservation stability of 24 hours. However, the lump arose by the storage stability test, and the toner of TM-5 and TY-5 brought a result also with a narrow non-offsetting temperature region.

[0221]

[Effect of the Invention] As mentioned above, according to this invention, it becomes possible by using a specific fluorine content polymer as a fixing assistant to realize oilless fixing which coexistence of high translucency and offset-proof nature is achieved, and does not carry out oil spreading.

[0222] Furthermore, the hydrophobic silica of the positive electrification nature of a toner parent and reverse electrification is \*(ed) outside. By furthermore using a negative electrification nature silica, low resistance metallic-oxide impalpable powder, and a metal acid chloride system particle for a hydrophobic silica, mixing The toner condensation seen with the toner which carried out fluorine content polymer combination, the image concentration fall by fault electrification by long-term continuous duty, Fogging under low-humidity/temperature can be prevented, the dispersibility of a fixing assistant is raised, it has uniform electrification distribution, and it becomes possible to continue outputting the image property stabilized even if it used it over a long period of time.

[0223] Moreover, even if it uses it for the 1 component developing-negatives method of a contact process again, neither the heat welding of a toner nor condensation is produced, but the stable development nature can be maintained.

[0224] Moreover, the inside omission at the time of an imprint and spilling are prevented by the conductive elastic roller and the electrophotography method using a middle imprint object, and it becomes possible to acquire high imprint effectiveness.

[0225] Moreover, also in the long-term use under highly humid, filming of a photo conductor and a middle imprint object can be prevented.

[0226] Moreover, even if it recycles a waste toner, there are not the amount of electrifications of a developer and a fluid fall, an aggregate is not produced, but reinforcement is attained, recycle development is enabled, and the re-activity of earth environmental pollution prevention and a resource can be enabled.

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[Translation done.]

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- 3.In the drawings, any words are not translated.

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] The cross section showing the configuration of the electrophotography equipment used in the example of this invention

[Drawing 2] The cross section showing the configuration of the electrophotography equipment used in the example of this invention

[Drawing 3] The cross section showing the configuration of the middle imprint belt unit used in the example of this invention

[Drawing 4] The cross section showing the configuration of the development unit used in the example of this invention

[Description of Notations]

2 Middle Imprint Belt Unit

3 Middle Imprint Belt

4 1st Imprint Roller

5 2nd Imprint Roller

6 Tension Roller

11 Photo Conductor

12 3rd Imprint Roller

17Bk(s), 17C, 17M, 17Y Image formation unit

18 Image Formation Unit Group

21 Image Formation Location

22 Laser Signal Light

35 Laser Beam Scanner Section

38 Mirror

308 Carrier

305 Development Sleeve

306 Doctor Blade

307 Magnet Roll

314 Cleaning Blade

312 Cleaning Box

311 Waste Toner

313 Waste Toner Duct

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[Translation done.]

## \* NOTICES \*

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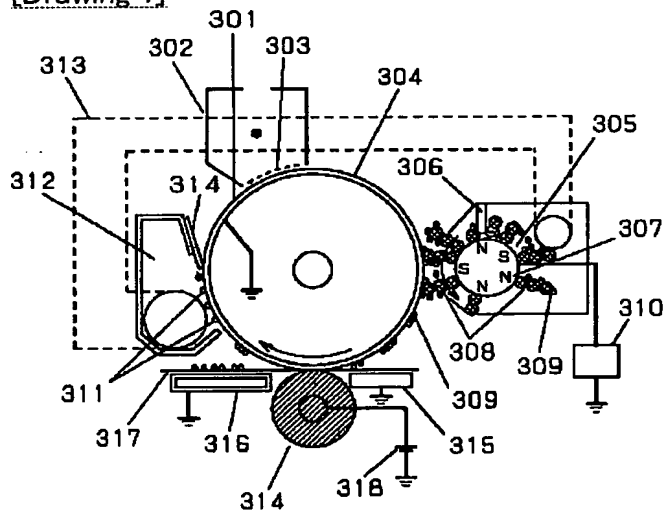
1.This document has been translated by computer. So the translation may not reflect the original precisely.

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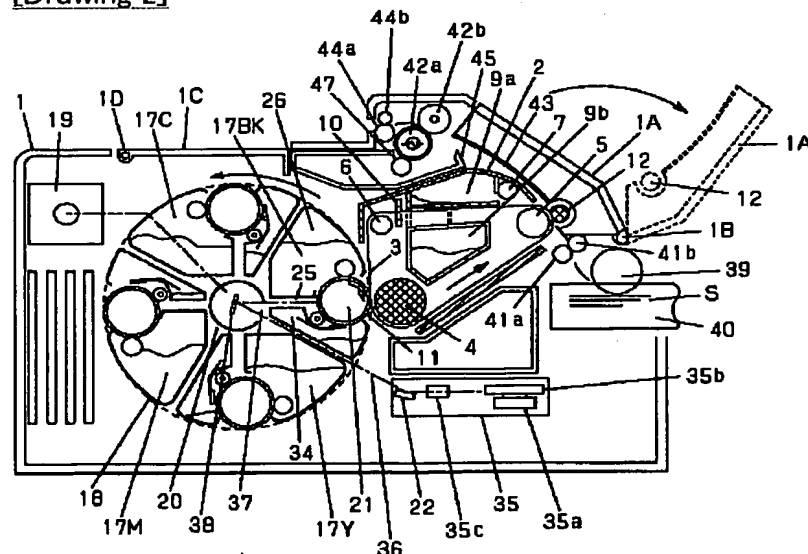
3.In the drawings, any words are not translated.

## DRAWINGS

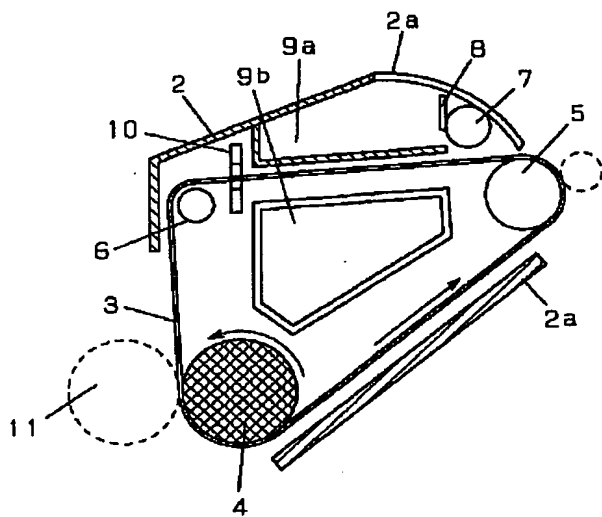
[Drawing 1]



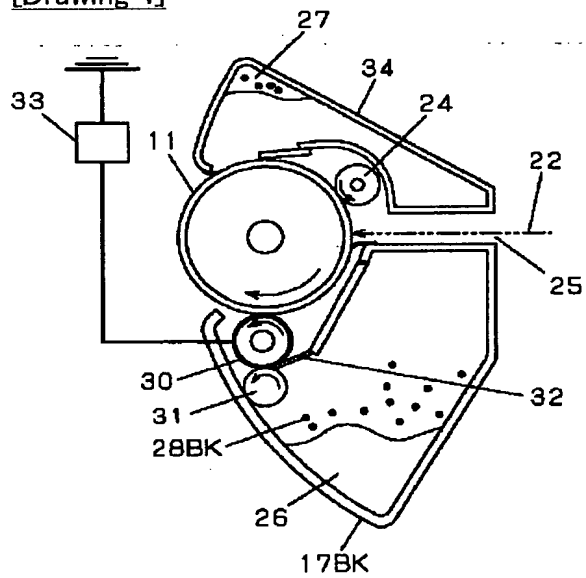
[Drawing 2]



[Drawing 3]



[Drawing 4]



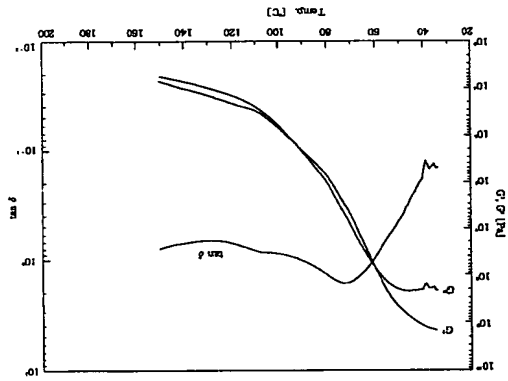
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(54) [発明の名称] 静電荷像現像用トナー及び画像形成方法

(57) [要約]  
【課題】 転写紙によらず低品定着性、面オフセット性、階調プロッキング性にも良好である静電荷像現像用トナーを提供すること。  
【解決手段】 結着樹脂、着色剤及びワックスを含有している静電荷像現像用トナーは、(a)損失弾性率と貯蔵弾性率の比  $(G''/G')$  が  $1.0$  となる温度が  $55 \sim 70^\circ\text{C}$  の温度領域に存在し、そのときの弾性率が  $1.5 \times 10^8 \text{ Pa}$  以下であり、(b)貯蔵弾性率  $(G')$  が  $40$  と貯蔵弾性率  $(G'_{50})$  の比  $(G'/G'_{50})$  が  $1.5 \sim 5.0$  であり、(c)貯蔵弾性率  $(G'_{50})$  と貯蔵弾性率  $(G'_{60})$  の比  $(G'_{50}/G'_{60})$  が  $3 \sim 2.0$  であり、(d)貯蔵弾性率  $(G'_{70})$  と貯蔵弾性率  $(G'_{100})$  の比  $(G'_{70}/G'_{100})$  が  $5.0 \sim 2.50$  であり、(e)貯蔵弾性率  $(G'_{110})$  と貯蔵弾性率  $(G'_{140})$  の比  $(G'_{110}/G'_{140})$  が  $2 \sim 2.0$  である静電荷像現像用トナー。



(1) 特許請求の範囲

【請求項1】 結着樹脂、着色剤及びワックスを含有している静電荷像現像用トナーにおいて、  
該トナーは、

- (a) 損失弾性率と貯蔵弾性率の比  $(G''/G' = \tan \delta)$  が  $1.0$  となる温度が  $55 \sim 70^\circ\text{C}$  の温度領域に存在し、かつ、そのときの弾性率が  $1.5 \times 10^8 \text{ Pa}$  以下であり、  
(b) 温度  $40^\circ\text{C}$  における貯蔵弾性率  $(G'_{40})$  と温度  $50^\circ\text{C}$  における貯蔵弾性率  $(G'_{50})$  の比  $(G'_{40}/G'_{50})$  が  $1.5 \sim 5.0$  であり、  
(c) 貯蔵弾性率  $(G'_{50})$  と温度  $60^\circ\text{C}$  における貯蔵弾性率  $(G'_{60})$  との比  $(G'_{50}/G'_{60})$  が  $3 \sim 2.0$  であり、  
(d) 温度  $70^\circ\text{C}$  における貯蔵弾性率  $(G'_{70})$  と温度  $100^\circ\text{C}$  における貯蔵弾性率  $(G'_{100})$  の比  $(G'_{70}/G'_{100})$  が  $5.0 \sim 2.50$  であり、  
(e) 温度  $110^\circ\text{C}$  における貯蔵弾性率  $(G'_{110})$  と温度  $140^\circ\text{C}$  における貯蔵弾性率  $(G'_{140})$  の比  $(G'_{110}/G'_{140})$  が  $2 \sim 2.0$  であることを特徴とする静電荷像現像用トナー。  
【請求項2】 該トナーは、比  $(G''/G')$  が  $1.0$  となる温度が  $58 \sim 68^\circ\text{C}$  の温度領域に存在し、そのときの弾性率が  $1 \times 10^8 \text{ Pa} \sim 1.3 \times 10^8 \text{ Pa}$  であることを特徴とする請求項1に記載の静電荷像現像用トナー。  
【請求項3】 該トナーは、比  $(G''/G')$  が  $1.0$  となる温度が  $59 \sim 65^\circ\text{C}$  の温度領域に存在し、そのときの弾性率が  $3 \times 10^7 \text{ Pa} \sim 1.0 \times 10^8 \text{ Pa}$  であることを特徴とする請求項1に記載の静電荷像現像用トナー。

【請求項4】 該トナーは、貯蔵弾性率  $(G'_{40})$  と貯蔵弾性率  $(G'_{50})$  との比  $(G'_{40}/G'_{50})$  が  $1.8 \sim 4.0$  であることを特徴とする請求項1乃至3のいずれかに記載の静電荷像現像用トナー。  
【請求項5】 該トナーは、貯蔵弾性率  $(G'_{40})$  と貯蔵弾性率  $(G'_{50})$  との比  $(G'_{40}/G'_{50})$  が  $2.0 \sim 3.5$  であることを特徴とする請求項1乃至3のいずれかに記載の静電荷像現像用トナー。

【請求項6】 該トナーは、貯蔵弾性率  $(G'_{50})$  と貯蔵弾性率  $(G'_{60})$  との比  $(G'_{50}/G'_{60})$  が  $4$  以上であることを特徴とする請求項1乃至5のいずれかに記載の静電荷像現像用トナー。  
【請求項7】 該トナーは、貯蔵弾性率  $(G'_{50})$  と貯蔵弾性率  $(G'_{60})$  との比  $(G'_{50}/G'_{60})$  が  $5$  以上であることを特徴とする請求項1乃至5のいずれかに記載の静電荷像現像用トナー。

【請求項8】 該トナーは、貯蔵弾性率  $(G'_{70})$  と貯蔵弾性率  $(G'_{100})$  との比  $(G'_{70}/G'_{100})$  が  $5.0 \sim 2.40$  であることを特徴とする請求項1乃至7のいずれかに記載の静電荷像現像用トナー。

【請求項9】 該トナーは、貯蔵弾性率  $(G'_{70})$  と貯蔵弾性率  $(G'_{100})$  との比  $(G'_{70}/G'_{100})$  が  $7.0 \sim 2.20$  であることを特徴とする請求項1乃至7のいずれかに記載の静電荷像現像用トナー。

【請求項10】 該トナーは、貯蔵弾性率  $(G'_{110})$  と貯蔵弾性率  $(G'_{140})$  との比  $(G'_{110}/G'_{140})$  が  $2.5 \sim 1.8$  であることを特徴とする請求項1乃至7のいずれかに記載の静電荷像現像用トナー。

【請求項11】 結着樹脂、着色剤及びワックスを含有している静電荷像現像用トナーにおいて、  
該トナーは、  
【請求項12】 該トナーは、貯蔵弾性率  $(G'_{110})$  と貯蔵弾性率  $(G'_{140})$  との比  $(G'_{110}/G'_{140})$  が  $2.5 \sim 1.8$  であることを特徴とする請求項1乃至7のいずれかに記載の静電荷像現像用トナー。

【請求項13】 該トナーは、貯蔵弾性率  $(G'_{110})$  と貯蔵弾性率  $(G'_{140})$  との比  $(G'_{110}/G'_{140})$  が  $3 \sim 1.5$  であることを特徴とする請求項1乃至7のいずれかに記載の静電荷像現像用トナー。

0のアリール基を示し、これらは同じであっても相互に異なっている。k, nは2~50の整数を要し、mは1~20の整数を要す。)で表わされるラジカル重合開始剤を含むモノマー組成物を50~120℃で重合反応する工程；

(1) 芳香族ビニルモノマー単独または芳香族ビニルモノマーと(メタ)アクリル酸エステルモノマーを重量比で20:1~1:1でアクリル酸エステルモノマーを再度加熱して温度55℃以上で重合反応する工程; 少なくとも2段階の異なる温度で重合反応する工程を逐次行うことと特徴としていることを特徴とする請求1乃至14のいずれかに記載の重合像現像用組成物。

【請求項18】 該積層樹脂は、2,500~50,000の数平均分子量(Mn)及び10,000~1,500,000の重量平均分子量(Mw)を有していることを特徴とする請求項1乃至17のいずれかに記載の静電複写用備用トナー。

【請求項19】 該トナーは、該トナーのT<sub>HF</sub>可溶分のGPCによる分子分布において、分子量12,000~40,000の領域及び分子量50,000~1,200,000の領域にそれぞれピークを有していることを特徴とする請求項1乃至18のいずれかに記載の静電顕像現用トナー。

【請求項20】 該トナーは、該トナーのTHF可溶分のGPCによる分子量分布において、分子量45,000以下の低分子量領域の面積(L)と分子量45,000を超える高分子量領域の面積(H)との比が下記関係(L):(H)=1:9~9.5~0.5

を満足することを特徴とする請求項 1 乃至 19 のいずれかに記載の静電荷像現像用トナー。

【請求項21】 静電蓄像保持体に保持されている静電蓄像をトナーにより現像し、トナー画像を形成する現像工程。

板トナ一画像を記録材に転写する転写工程及び該記録材に転写されたトナ一画像を加熱定着手段により該記録材に加熱定着する定着工程、を有する画像形成方法において、

該トナーは、結着樹脂、着色剤及びワックスを含有して

(a) 損失弾性率と貯蔵弾性率の比 ( $G'/G'' = \tan \delta$ ) が 1.0 となる温度が 55~70℃ の温度領域に存在し、かつ、そのときの弾性率が  $1.5 \times 10^8$  Pa 以下であり、

(b) 温度 40℃ における貯蔵弾性率 ( $G'_{40}$ ) と温度 50℃ における貯蔵弾性率 ( $G'_{50}$ ) の比 ( $G'_{40}/G'_{50}$ ) が 1.5~5.0 であり、

(c) 核貯蔵弾性率 ( $G'_{50}$ ) と温度  $60^\circ\text{C}$  における貯蔵弾性率 ( $G'_{60}$ ) との比 ( $G'_{50}/G'_{60}$ ) が  $3 \sim 2$

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とを特徴とする請求項1乃至14のいずれかに記載の淨電荷像現像用トナー。

【請求項16】 軟結着樹脂は、(i) 芳香族ビニルモノマー単独または芳香族ビニルモノマーと(メタ)アクリル酸エステルモノマーを重量比で20:1~1:1で混合したモノマー混合物と、下記化学式(1)、

(2), (3), 又は (4)

添加して温度55℃以上で重合反応する工程；かならず  
少なくとも2段階の異なる温度で重合反応する工程を経  
て合成された共重合体を含有していることを特徴とする  
請求項2乃至34のいずれかに記載の画像形成方法。  
【請求項38】 酸基樹脂は、2.500～50.0  
00の酸平均分子量(Mn)及び10.000～1.5  
00.000の重量平均分子量(Mw)を有しているこ  
とを特徴とする請求項2乃至37のいずれかに記載の  
画像形成方法。

【請求項39】 該トナーは、該トナーのTHF可溶分  
のGPCによる分子重量分布において、分子量12,00  
0～40,000の領域及び分子量50,000～1,  
200,000の領域にそれぞれピークを有しているこ  
とを特徴とする請求項2乃至38のいずれかに記載の  
画像形成方法。

【請求項40】 該トナーは、該トナーのTHF可溶分  
のGPCによる分子重量分布において、分子量45,00  
0以下の低分子重量領域の面積(L)と分子量45,00  
0を超える高分子重量領域の面積(H)との比が下関係  
(L)：(H)=1：9～9.5～0.5

を満足することを特徴とする請求項2乃至39のいづ  
れかに記載の画像形成方法。

【請求項41】 該静電潜像保持体は、電子写真感光  
体であることを特徴とする請求項2乃至40のいづれ  
かに記載の画像形成方法。

【請求項42】 該加熱定着手段は、加熱ローラー及び  
加圧ローラーを有する加熱加圧ローラー定着装置である  
ことを特徴とする請求項2乃至41のいずれかに記載の  
画像形成方法。

【発明の詳細な説明】

【発明の属する技術分野】 本発明は、電子写真法、静電  
記録法、静電印刷法の如き画像形成方法に用いられる静  
電荷像現像用トナー及び該トナーを用いた画像形成方法  
に関する。

【0002】

【従来の技術】 電子写真法としては米国特許第2,29  
7,691号明細書、特公昭42-23910号公報及  
び特公昭43-24748号公報に記載されている如く

多数の方法が知られている。一般には光導電性物質を利  
用し、種々の手段により感光体上に静電荷像を形成し、  
次いで該静電荷像をトナーを用いて現像し、必要に応じ  
て紙の如き記録材にトナーを転写した後、加熱、圧  
力、加熱加圧あるいは溶剤蒸気によりトナー画像を記録材  
に定着し、定着画像を得るものである。

【0003】 上述の最終工程であるトナー画像を紙の如  
き記録材に定着する工程に関して種々の方法や装置が開  
発されているが、現在最も一般的な方法は熱ローラー又  
は熱熱フィルムを介した固定発熱ヒータによる圧着加熱  
方式である。

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【0004】 加熱ローラーによる圧着加熱方式は、トナ  
ーに対し糊型性を有する熱ローラーの表面と記録材であ  
る被定着シートのトナー画像面を加圧下で接触しながら  
記録材を通してあることによりトナー画像の定着を行  
なうものである。この方法は熱ローラーの表面と記録材  
上のトナー画像とを加圧下で接触するため、トナー画像  
を記録材上に定着する際の熱効率が悪く良好であり、  
迅速に定着を行うことができる。

【0005】 加熱ローラー表面とトナー画像とを加圧下  
で、かつ、トナー画像が溶融状態で接触する為に、トナ  
ー画像の一部が定着ローラー表面に付着し転移し、次の  
記録材にこれが転移し、記録材を所す「オフセット現  
象」が定着速度及び定着温度の影響を大きく受ける。一  
般に定着速度が遅い場合は、加熱ローラーの表面温度は  
比較的低く設定され、定着速度が速い場合は、加圧ロー  
ラーの表面温度は比較的高く設定される。これは、トナ  
ーを定着させる為に加熱ローラーからトナーに与える熱  
量を、定着速度によらずほぼ一定にするためである。

【0006】 記録材上のトナーは、何層かのトナー層を  
形成している為、特に定着速度が遅く、加熱ローラーの  
表面温度が高い系においては、加熱ローラーに接触する  
トナー層と、記録材に接触している最下層のトナー層と  
の温度差が、大となる為、加熱ローラーの表面温度が  
高い場合には、最上層のトナーがオフセット現象を起こ  
しやすく、加熱ローラーの表面温度が低い場合は、最下  
層のトナーは十分に溶けにくい為、記録材にトナーが定  
着せず「低温オフセット」という現象が起きやすい。

【0007】 この問題を解決する方法として、定着速度  
が遅い場合には、定着時の圧力を上げ、記録材へトナ  
ーをアンカリングさせる方法が、通常行われている。こ  
の方法だと、加熱ローラー温度をある程度下げることが  
でき、最上トナー層の高温オフセット現象を防ぐことは  
可能となる。しかし、トナーにかかるせん断力が非常に  
大となる為、記録材が定着ローラーに巻きつき、巻き  
つきオフセットが発生したり、定着ローラーから記録材  
を分離するための分離爪の分離あとが定着画像に出現し  
やすい。さらには、圧力が高いゆえに、定着時にライ  
ン画像が押しつぶされたり、トナーが飛びちったりして  
定着画像の画質劣化を生じ易い。

【0008】 高速定着では、一般的には、低速定着の場  
合より溶融粘度の低いトナーを用い、加熱ローラーの表  
面温度を下げ定着圧力を下げることににより、高温オフセ  
ットや巻きつきオフセットを防止しつつ、トナー画像を  
定着している。しかし、この様な溶融粘度の低いトナ  
ーを低速定着に用いると、高温でオフセット現象が発生し  
やすい。

【0009】 定着において、低速から高速まで適用でき  
る、定着温度領域の広い、耐オフセット性にすぐれ、か  
つ、再生紙を含有し多量多量転写線に対してしても等しく良  
好な定着性を示すトナーが特許されている。

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【0010】 トナーの小粒径化により、画像の解像力や  
線減度が上がる一方で、小粒径のトナーで形成したハー  
ブトーン部の定着性が低下する。この現象は特に高速定  
着において、顕著である。これは、ハーフトーン部分の  
トナーの載り量が少なく、記録材の凹部に転写されたト  
ナーは、加熱ローラーから与えられる熱量が少なく、さ  
らに定着圧力も、記録材の凸部によって凹部への圧力が  
抑制される為に悪くなるからである。ハーフトーン部分  
で被定着シートの凸部に転写されたトナーは、トナー層  
厚が薄いため、トナー粒子1個当たりにかかるとせん断力は  
トナー層厚の厚いベータ黒部分に比べ大きいものとなり、  
オフセット現象が発生しやすく、低画質の定着画像とな  
りやすい。

【0011】 特開平1-128071号公報には、ポリ  
エステル樹脂を結着樹脂とし、95℃で特定の貯蔵粘性  
率を有する電子写真現像用トナーが開示されているが、  
いまだ定着性及び耐オフセット性を改善する必要がある。

【0012】 特開平4-353866号公報には、貯蔵  
弾性率の低下開始温度が100～110℃の範囲内にあ  
り、150℃において特定の貯蔵弾性率を有し、損失弾  
性率のピーク温度が125℃以上であるポリオレフィン特  
性を有する電子写真用トナーが開示されている。しかしな  
がら、貯蔵弾性率及び損失弾性率ともに小さすぎ、かつ  
損失弾性率のピーク温度が高すぎるため、低速定着性は  
改善されず、貯蔵弾性率及び損失弾性率ともに低すぎる  
ために、耐熱性が低い。

【0013】 特開平6-59504号公報には、特定の  
構造を有するポリエステル樹脂をバインダー樹脂とし、  
トナーが70～120℃で特定の貯蔵弾性率を有し、1  
30～180℃で特定の損失弾性率を有する結着樹脂の現  
像用トナーが開示されている。しかしながら、70～1  
20℃の貯蔵弾性率が大きく、130～180℃の損失  
弾性率は小さいために小粒径樹脂トナーの場合には低温  
で定着されにくく、耐オフセット性も改善が望まれる。

【0014】 特開平7-224103号公報には、分子  
内に通融化物質を2個有する樹脂重合開始剤を用いたトナ  
ー用樹脂に用いられる高分子量樹脂の製造方法が開示され  
ている。しかしながら、高分子量樹脂の製造しかできな  
いためにトナーの低速定着性は改善されない。

【0015】 高分子論文集46巻(2) 81～87ペ  
ースには、ポリメリックペルオキシを用いた含フッ素  
ブロック共重合体の合成に関する報告があり、Poly  
mer Journal, 24, 971 (1992) に  
は分子内に2個の通融化物質を有するラジカル重合開始  
剤の反応機構に関する報告がされている。

【0016】 小粒径の磁性トナーの磁性体の含有量が多  
い場合に定着性の問題が顕著である。レオロジーの観点  
からすれば、トナーに含有される着色剤の増加は貯蔵弾  
性率及び損失弾性率を増大する傾向にあり、使用する転

【0025】本発明の目的は、80g/m<sup>2</sup>以上の厚みの厚い紙手紙に対して良好な定着性を有し、かつ一定の速さでより高速となり、かつ更に厚みの厚い120g/m<sup>2</sup>以上の紙手紙に対しても良好な定着性を有する静電荷像現像用トナー及び画像形成方法を提供することである。

【0026】問題を解決するための手段】上記目的は、以下の本発明の構成により達成される。

【0027】本発明は、着色剤及びワックスを含有している静電荷像現像用トナーにおいて、該トナーは、(a)損失弾性率と貯蔵弾性率の比  $(G'/G'')$  =  $\tan \delta$  が1.0となる温度が5〜70℃の温度領域に存在し、かつ、そのときの弾性率が1.5×10<sup>8</sup> Pa以下であり、(b)温度40℃における貯蔵弾性率  $(G'$  40) と温度50℃における貯蔵弾性率  $(G'$  50) の比  $(G'/G'')$  が1.5〜5.0であり、(c)貯蔵弾性率  $(G'$  50) と温度60℃における貯蔵弾性率  $(G'$  60) との比  $(G'/G'')$  が3〜20であり、(d)温度70℃における貯蔵弾性率  $(G'$  70) と温度100℃における貯蔵弾性率  $(G'$  100) の比  $(G'/G'')$  が2〜20であることを特徴とする静電荷像現像用トナーに関する。

【0028】さらに本発明は、静電増像保持性に保持されている静電荷像をトナーにより現像し、トナー画像を形成する現像工程、該トナー画像を記録材に転写する転写工程及び記録材に転写されたトナー画像を加熱定着手段により記録材に加熱定着する定着工程、を有する画像形成方法において、該トナーは、着色剤、着色剤及びワックスを含有しており、該トナーは、(a)損失弾性率と貯蔵弾性率の比  $(G'/G'')$  =  $\tan \delta$  が1.0となる温度が5〜70℃の温度領域に存在し、かつ、そのときの弾性率が1.5×10<sup>8</sup> Pa以下であり、(b)温度40℃における貯蔵弾性率  $(G'$  40) と温度50℃における貯蔵弾性率  $(G'$  50) の比  $(G'/G'')$  が1.5〜5.0であり、(c)貯蔵弾性率  $(G'$  50) と温度60℃における貯蔵弾性率  $(G'$  60) との比  $(G'/G'')$  が3〜20であり、(d)温度70℃における貯蔵弾性率  $(G'$  70) と温度100℃における貯蔵弾性率  $(G'$  100) の比  $(G'/G'')$  が2〜20であることを特徴とする画像形成方法に関する。

【0029】上記トナーは、比  $(G'/G'')$  が1.0となる温度が5〜68℃の温度領域に存在し、そのときの弾性率が1×10<sup>7</sup> Pa〜1.3×10<sup>8</sup> Paである。

手紙によっては顕著な定着性が悪化する場合があります。改善を求められている。

【0017】特開平8-234480号公報（対欧州特許出願公開E P-A 0718703）は、温度100℃における貯蔵弾性率  $(G'$  100) 及び温度60℃における貯蔵弾性率  $(G'$  60) と温度70℃における貯蔵弾性率  $(G'$  70) との比  $(G'/G'')$  を規定したトナーを提案している。

【0018】このトナーは、その粘弾性的な特性から、定着時に定着器より一定量以上の熱量が供給される場合には迅速に融解し、強固に転写材上に固定、定着されるものである。また、前プロセスに於いて、示量走査量計 (DSC) により測定されるガラス転移温度 (T<sub>g</sub>) 近傍の温度において十分に高い貯蔵弾性率を有するために、高温の環境に長時間放置されても凝集、変形することが少ないものであるから定着性と前プロセスの両方に優れ、かつ寒冷時において電源投入直後の下部ローラーが十分に加熱されていない状態でも優れた定着性が得られるもの、記録材が厚みのある80g/m<sup>2</sup>の紙手紙や120g/m<sup>2</sup>の紙手紙に定着する場合には、定着時に下部ローラー（加圧ローラー）側から熱が記録材に奪われてしまうことから特に定着スピードが遅い定着条件で定着した場合に、トナーに対しても十分に熱が付与されなくなり、また、熱の付与に対しても熱が付与されなくなり、定着面の画像濃度が低下する傾向があり、さらに改善すべき点を有している。

【0019】【発明が解決しようとする課題】本発明の目的は、上述の如き問題を解決した静電荷像現像用トナー及び画像形成方法を提供することである。

【0020】本発明の目的は、トナーの粒径及びこれに伴う着色剤（特に炭素粉）の含有量が増大しても良好な定着性を示す静電荷像現像用トナー及び画像形成方法を提供することである。

【0021】本発明の目的は、再生紙を含めた多種多様な紙手紙に対しても良好に定着し得る静電荷像現像用トナー及び画像形成方法を提供することである。

【0022】本発明の目的は、低速から高速まで、かつ耐オフセット性、前プロセスに於いて、定着性が良好であり、かつ耐オフセット性、前プロセスに於いて、流動性に優れた静電荷像現像用トナー及び画像形成方法を提供することである。

【0023】本発明の目的は、ハーフトーン部分においてもすぐれた定着性を示し、かつ、良画質の定着画像を得ることのできる静電荷像現像用トナー及び画像形成方法を提供することである。

【0024】本発明の目的は、低速から高速まで、かつ、カブリがなく、高濃度のコピー画像が得られる静電荷像現像用トナー及び画像形成方法を提供することである。

【0030】上記トナーは、比  $(G'/G'')$  が1.0となる温度が5〜65℃の温度領域に存在し、そのときの弾性率が3×10<sup>7</sup> Pa〜1.0×10<sup>8</sup> Paであることが好ましい。

【0031】上記トナーは、貯蔵弾性率  $(G'$  40) と貯蔵弾性率  $(G'$  50) との比  $(G'/G'')$  が1.8〜4.0であることが好ましい。

【0032】上記トナーは、貯蔵弾性率  $(G'$  40) と貯蔵弾性率  $(G'$  50) との比  $(G'/G'')$  が2.0〜3.5であることが好ましい。

【0033】上記トナーは、貯蔵弾性率  $(G'$  50) と貯蔵弾性率  $(G'$  60) との比  $(G'/G'')$  が1.5〜2.0であることが好ましい。

【0034】上記トナーは、貯蔵弾性率  $(G'$  50) と貯蔵弾性率  $(G'$  60) との比  $(G'/G'')$  が1.5〜2.0であることが好ましい。

【0035】上記トナーは、貯蔵弾性率  $(G'$  70) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が6.0〜24.0であることが好ましい。

【0036】上記トナーは、貯蔵弾性率  $(G'$  70) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が7.0〜22.0であることが好ましい。

【0037】上記トナーは、貯蔵弾性率  $(G'$  100) と貯蔵弾性率  $(G'$  140) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

【0038】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

【0039】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

【0040】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

【0041】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

【0042】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

【0043】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

【0044】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

【0045】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

【0046】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

【0047】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

【0048】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

【0049】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

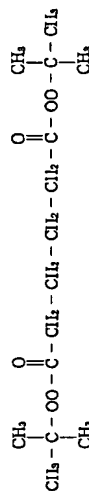
【0050】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

【0051】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。

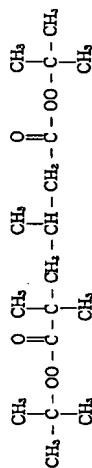
【0052】上記トナーは、貯蔵弾性率  $(G'$  140) と貯蔵弾性率  $(G'$  100) との比  $(G'/G'')$  が2.0〜20.0であることを特徴とする。



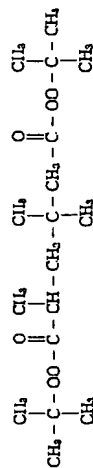
例示化合物 (1-1)



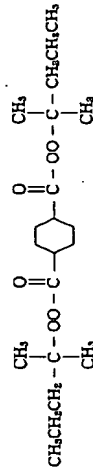
例示化合物 (1-2)



例示化合物 (1-3)



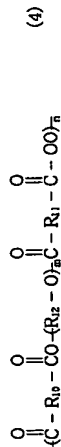
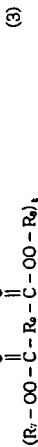
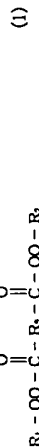
例示化合物 (1-4)



[0075] 化学式 (2) で表わされるラジカル重合開始剤としては、例えば以下の例示化合物 (2-1) ~ (2-7) を挙げることができる。

[0076] 化学式 (2) で表わされるラジカル重合開始剤としては、例えば以下の例示化合物 (2-1) ~ (2-7) を挙げることができる。

19  
トのみによって構成されるブロックとを有するブロック重合体。  
[0069] (i v) 芳香族ビニルモノマーユニット及び (メタ) アクリル酸エステルモノマーユニットによって構成されるブロックと芳香族ビニルモノマーユニット及び (メタ) アクリル酸エステルモノマーユニットによって構成されるブロックとを有するブロック重合体。  
[0070] 上記のような芳香族ビニル (メタ) アクリル酸エステルブロック重合体、芳香族ビニルモノマーと (メタ) アクリル酸エステルモノマーをパーオキサイド基を分子内に2個以上有し、各々のパーオキサイド基



[0073] 化学式 (1) で表わされるラジカル重合開始剤としては、例えば以下の例示化合物 (1-1) ~ (1-4) を挙げることができる。  
[0074] 化学式 (1) で表わされるラジカル重合開始剤としては、例えば以下の例示化合物 (1-1) ~ (1-4) を挙げることができる。

[0075]

[0076]

[0077]

[0078]

[0079]

[0080]

[0081]

[0082]

[0083]

[0084]

[0085]

[0086]

[0087]

[0088]

[0089]

[0090]

[0091]

[0092]

[0093]

[0094]

[0095]

[0096]

[0097]

[0098]

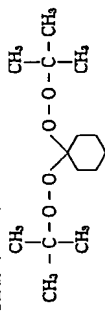
[0099]

[0100]

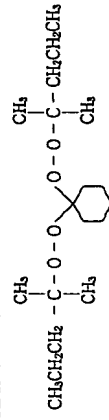
24

(13)

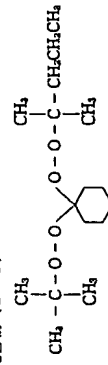
23 例示化合物 (2-1)



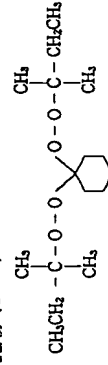
例示化合物 (2-2)



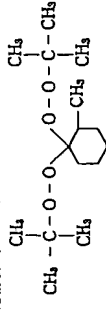
例示化合物 (2-3)



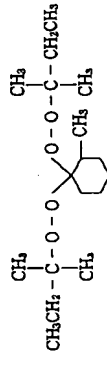
例示化合物 (2-4)



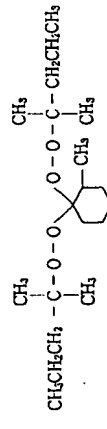
例示化合物 (2-5)



例示化合物 (2-6)



例示化合物 (2-7)



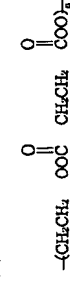
[0077] 化学式 (3) で表わされるラジカル重合開始剤として、例えば以下の例示化合物 (3-1) ~

(3-5) を挙げる。

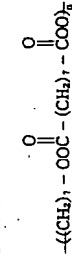
[0078]

[外13]

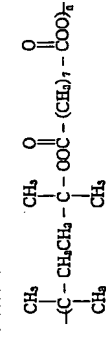
25 例示化合物 (3-1)



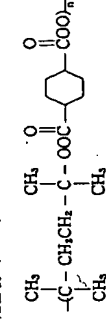
例示化合物 (3-2)



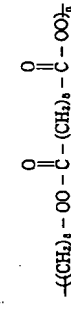
例示化合物 (3-3)



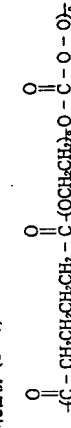
例示化合物 (3-4)



例示化合物 (3-5)



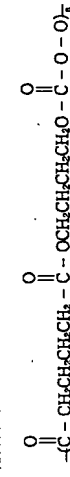
例示化合物 (4-1)



例示化合物 (4-2)



例示化合物 (4-3)



[0081] 化学式 (1) ~ (4) で表わされるラジカル重合開始剤 (以下、本発明に係る重合開始剤とする)





10

合は、好ましくは溶融重合及び懸濁重合により製造することができる。

【0102】本発明に係るブロック多重化は用いられ  
る芳香族ビニルモノマーとしては、スチレン、 $\alpha$ -メチ  
ルスチレン、 $m$ -メチルスチレン、 $p$ -メチルスチレ  
ン、 $m$ -メトキシスチレン、 $p$ -フエニルスチレン、 $p$ -エ  
クロルスチレン、3,4-ジクロルスチレン、 $p$ -エ  
チルスチレン、2,4-ジメチルスチレン、 $p$ - $n$ -  
ブチルスチレン、 $p$ - $t$ -ブチルスチレン、 $p$ - $n$ -  
ヘキシルスチレン、 $p$ - $n$ -オクチルスチレン、 $p$ -  
 $n$ -デシルスチレン、 $p$ - $n$ -デシルスチレン、 $p$ - $n$ -  
ドデシルスチレンが挙げられるが、好ましくはスチレ  
ン、 $\alpha$ -メチルスチレン、 $m$ -メチルスチレン、 $p$ -メ  
チルスチレンである。

[illegible]

【0104】本発明において、芳香族ビニル（メタ）アクリル酸エステルブロック共重合体は、他のモノマーユニットを上記 (i) ~ (iv) の4つの形態で説明した各ブロックに含有することも可能である。

[illegible]

和酸のエステル、二塩基酸のジエステル類が挙げられ  
る。

[0106] さらに、マレイン酸、シトラロン酸、イタコン酸、アルケニルコハク酸、フマル酸及びメサコン酸の如き不飽和と二重基酸、マレイン酸無水物、シトラロン酸無水物、イタコン酸無水物及びアルケニルコハク酸無水物の如き不飽和と二重基酸無水物；マレイン酸メチルハーフエステル、マレイン酸エチルハーフエステル、シトラロン酸メチルハーフエステル、シトラロン酸エチルハーフエステル、シトラロン酸ブチルハーフエステル、イタコン酸メチルハーフエステル、イタコン酸エチルハーフエステル、アルケニルコハク酸メチルハーフエステル、フマル酸メチルハーフエステル及びメサコン酸メチルハーフエステルの如き不飽和と二重基酸のカーボエステル；ジメチルマレイン酸及びジメチルシトラロン酸の如き不飽和と二重基酸無水物；アクリル酸、メタクリル酸、クロロトロン酸及びケイヒ酸無水物の如き $\alpha$ 、 $\beta$ -不飽和酸；クロトン酸無水物及びケイヒ酸無水物の如き $\alpha$ 、 $\beta$ -不飽和酸と低級脂肪族の無水物； $\alpha$ 、 $\beta$ -不飽和酸と低級脂肪族の無水物；アルケニルマロロン酸、アルケニルグルタマ酸、アルケニルアジピン酸、これらの酸無水物及びこれらのモノ/エステル物の如きカルボキシ基を有するモノマーが挙げられる。

【0107】これらの他のモノマーは、ブロック共重合体の全モノマーユニット基準で、好ましくは、25%以下、より好ましくは、18%以下、さらに好ましくは、12%以下で含有されていることが低温度性と耐オキシゼット性あるいは低温度性と耐ブロッキング性を両立し、かつ、トナーの現象性を損う可能性が低く好ましい。

[illegible][illegible]

リ、リノ酸アミド、エチレンビスカプリン酸アミド、エチレンビスタラクリン酸アミド及びヘキサメチレンビスステアレン酸アミドの如き飽和脂肪族ビスアミド類；エチレンビスオレフィン酸アミド、ヘキサメチレンビスオレフィン酸アミド、 $N, N'$ -ジオクトイルアジバチ酸アミド及びヒンメル、 $N, N'$ -ジオレイルセパシン酸アミドの如き不飽和脂肪族ビスアミド類； $m$ -キレンリン酸アミドの如き芳香族ビスアミド類； $N$ -ジステアリルソフタル酸アミドの如き芳香族ビスアミド類；ステアリリン酸カルバウム、ラウリン酸カルバウム、ステアリリン酸亜鉛及びステアリリン酸マグネシウムの如き脂肪族金属塩（一般に金属塩にスチレンが加わっているもの）；脂肪族炭素系化合物を用いてグラフト化させたワックス類、 $\beta$ -ヘン酸モノグリセリドの如き脂肪族多価アルコールの部分エステル化合物；植物性油類の水素添加によって得られるヒドロキシカル基を有する、エステル添加化合物と導かれる。

【0109】本発明においてトナーは、示差走査熱量計で測定されるDSC曲線において、好ましくは、温度65乃至160℃の吸熱、より好ましくは、70〜160℃の吸熱、さらに好ましくは72〜155℃の吸熱に吸熱メインピークを有することがトナーの低温度着性及び前オフセット性の点で好ましい。

【0110】さらに好ましくは、トナーは、示差走査顕微鏡で測定されるDSC曲線において、温度72～155℃の領域に吸熱メインピークと吸熱サブピーク又は吸熱シヨルダとを有していることが低温定着、耐オフセット性及び耐ブロッキング性の点で好ましい。

[0111] このトナーのDSC曲線における吸熱メ  
インピークが65℃未満の場合には、トナーのガラス転移  
温度付近での貯電率低下が低くならず、 $160^\circ\text{C}$ を超える  
場合には、樹脂プロセス性が低下し、 $160^\circ\text{C}$ を超えてる  
場合には、劣化と相関される結着樹脂のガラス状態から  
溶融に至る相変化特性が低下すること、阻害される場  
合があり、トナーの低温安定性が低下する。

【0112】 トナーのDSC曲線において、温度65.5乃至16.0°の傾斜に明瞭な吸熱ピークを形成するために、使用されるワックスが限定される。後述の示差走査熱重量計による温度30〜200°の範囲内におけるワックスのDSC曲線において、最大吸熱ピークに対する温度差をワックスの融点と定義すると、ワックスとしては、融点が65〜160°であるものが好ましく使用される。ワックス性を向上させるために、機能分離していることが好ましいことから、ワックスは、相対的に融点の低い低融点ワックス成分及び相対的に融点の高い高融点ワックス成分が少なくとも2種類で形成されていることが好ましく、より具体的には、低融点ワックス成分が融点65〜190°であることが好ましく、高融点ワックス成分が70〜115°であるものが良い。高融点ワックス成分は、融点115〜160°であることが好ましい。

成分は、融点が120～160℃であることが好ま  
しく、より好ましくは融点が125～155℃であ  
ることが好ましい。融点が130～150℃のものが良  
い。〔0.11.3〕低融点ワックス成分の融点は5℃未満と  
なる場合には、トナーのガラス転移温度付近の貯蔵環境  
下で融点特性が低下する。高融点ワックス成分の融  
点はトナーに含有される結晶性樹脂のガラス転移温  
度と接近する場合には、トナーの低吸湿性が低下す  
る。トナーの低吸湿性を確保し、トナーの低吸湿性  
を低下させる場合があり、トナーの低吸湿性を低下  
させるとともに、トナーの低吸湿性を低下させる  
ことが好ましい。〔0.11.4〕低融点ワックス成分と高融点ワックス成分  
を混合して使用することにより、トナーのDSC  
熱曲線に所定の吸熱メーンピーク及び吸熱サブピーク又は  
吸熱ブロードピークを形成させることができる。

【0115】更に好ましくはワックスは、低融点ワックス成分と高融点ワックス成分とからなり、低融点ワックス成分及び高融点ワックス成分は下記条件

【0116】  
【外15】

$$80 \leq \frac{T_{\text{нл}} + T_{\text{нн}}}{2} \leq 110$$

〔式中、 $T_{ML}$ は低融点ワックス成分の融点を示し、 $T_{MH}$ は高融点ワックス成分の融点を示す。〕を満足しているのが良い。

【0117】さらに、低融点ワックス成分の融点 ( $T_{MH}$ ) と高融点ワックス成分の融点 ( $T_{MH}$ ) との差が 30 乃至 90℃であることが好ましい。

【0118】本発明のトナーに用いられるワックスにおいては、低熔点ワックス成分と高熔点ワックス成分の使用比率は低熔点ワックス成分が1/19~1/41であることが好ましく、より好ましくは1/9~1/4であり、更に好ましくは1/9~2/1である。上記配合割合を満足することにより、低熔点ワックス成分と高熔点ワックス成分の寄与によってトナーの低熔点性、耐ブロッキング性、耐付着性を、より向上させることが可能である。

【0119】低酸素ワックス成分及び高酸素ワックス成分以外に本発明の効果を阻害しない範囲で他の第3ワックス成分を、低温度性、耐プロキシ性又は耐オフセツティング性の微妙な調整のために1種以上含有させることができる。他のワックス成分の含有量は全ワックス量に対して20重量%以下であり、融点は60〜150℃であることが好ましい。

[illegible]

着性、耐ブロッキング性及び耐オフセット性を向上さ

リリ、酸アミド、エチレンビスカプリン酸アミド、エチレンビスアクリル酸アミド及びヘキサメチレンビスステアリン酸アミドの如き飽和脂肪酸アミド類、エチレンビスオレイン酸アミド、ヘキサメチレンビスオレイン酸アミド、N、N'-ジオキソライルジペン酸アミド及びN、N'-ジオレイルセパシン酸アミドの如き不飽和脂肪酸アミド類；m-キレンリンビスステアアミド及び防蝕アミド類；m-キレンリンビスアクリル酸アミドの如き芳香族系ビスアミド類；ステアリン酸カルkungム、ラウリン酸カルkungム、ステアリン酸亜鉛及びステアリン酸マグネシウムの如き脂肪酸金属塩（一般に金属炭酸として用いられているもの）；脂肪族炭素塩（水素系モノマーを用いてグラフト化させたワックスクラス、ヘブニエンモノグリセリドの如き脂肪酸と多価アルコールの部分エステル化合物；植物油の水添加によって得られる、二重結合を有するエステル類）等から選ばれ、

【0109】本発明においてトナーは、示差走査熱量計で測定されるDSC曲線において、好ましくは、温度65乃至160℃の吸熱、より好ましくは、70~160℃の吸熱、さらに好ましくは72~155℃の吸熱に吸熱メインピークを有することがトナーの低湿定着性及び前オフセット性の点で好ましい。

[0110] さらに好ましくは、トナーは、示差走査熱  
量計で測定されるDSC曲線において、温度12〜15  
5℃の領域に吸熱メインピークと吸熱サブピーク又は吸  
熱シヨルダーとを有していることが低温度帯、前オフセ  
ット性及び前ブロッキング性の点で好ましい。

【0111】このトナーのDSC曲線における吸熱メ  
インピークが65℃未満の場合には、トナーのガラス転移  
温度付近での貯蔵寿命性が低くなりすぎる場合があり、  
トナーの脂肪族性が低下し、160℃を超える  
場合には、トナーに含まれる結着樹脂のガラス転移  
から溶融に至る相変化が相次いで行いことが阻害される場  
合があり、トナーの低吸着性が低下する。

[0112] トナーのDSC曲線において、温度65乃至160℃の領域に明顯な吸熱ピークを形成するために、使用するワックスが限定される。後述の示差走査熱量計によるワックス30～200℃の範囲におけるワックスのDSC曲線において、最大吸熱ピークに対する温度点をワックスの融点と定義すると、ワックスとしては、融点が65～160℃であるものが好ましく使用される。ワックス性向上させるために、機能分離している低熔点ワックス成分においても、トナーの低温度安定性及び耐高湿化が好ましいことから、ワックスは、相対的に融点の低い低熔点ワックス成分及び相対的に融点の高い高熔点ワックス成分の少なくとも2種類で形成されていることが好ましい。より具体的に、低熔点ワックス成分が融点65～190℃であることが好ましく、高熔点ワックス成分が700～1150℃であるものが良い。高熔点ワックス成分が700～1150℃であることが好ましく、より好ましくは

せ、さらに、トナー粒子からの遊離ワックス粒子の量を低下させることが可能である。

[0121] 本発明においては、好ましく用いられる塩酸点ワックス成分としては、分岐の少ない長鎖アルキル基を有する炭化水素ワックスが挙げられる。具体的にはアングラゲラー触媒で重合した分子重量のアルキレンポリマーワックス；高圧下でラジカル重合あるいは低圧下でチレネのアルキレンポリマーワックス；一級炭化政策及び水素添加したアルキレンポリマーワックス；一級炭化政策及び水素添加した炭化水素の高重合体から、あるいはこれらを水素添加して得られる含有炭化政策のワックスがよい。更に、プレス発汗法、焙煎法、真空蒸留の利用や分別精製方式により炭化水素ワックスの分別を行ったものにより、母体としての炭化水素は、金属触媒好ましくはワックス（多くは2種以上の多元素）を使用した、一級炭化政策と水素の反応によって合成されるポリメチレンワックスが挙げられる。さらに、例えばジントール法、ヒドロコロム法（流動触媒を使用）、あるいはワックス状により得られるワックスのアグゼン（固定触媒を使用）により得られるワックスが挙げられる。

【0122】上記環状アルキル基は末端の一部が水酸基及び酸基から誘導される官能基（例えばカルボキシ基、エステル基、エトキシ基、スルホニル基等）で置換されている。また、環状アルキル基は例えば、その環の製法により得られ、エチレンをチラグララ触媒を用いて重合し重合終了後、酸処理で、脂肪酸金属とポリエチレンとのアルコキシドを生成する。この後、加水分解することにより、環状アルキルアルコールを得る。この環に於いて得られた環状アルキルアルコールは、分岐が少なく小さく、さらに分子量分布がシャープであり、本発明の目的にさらにも適するものである。

[0123] 本発明において好ましく用いられる高酸化ポリアクリル酸成分としては、分岐の少ないより長鎖のアルキレンジカルを有する酸化水素ワック及びエチレン・プロピレン共重合体が挙げられる。具体的には、例えばアルキレンを重直下で低分子重合あるいは低直下でチーグラー触媒で重合した低分子量のアルキレンポリマーワックス；高分子量のアルキレンポリマーを熱分解して得られるアルキレンポリマーワックス、一酸化炭素及び水素からなる炭化水素からアーク法により得られるポリメチレンの酸化水素の蒸留費分、あるいはこれらによる水素源として得られる合成炭化水素のワックスがある。

【0124】上記長鎖アルキル基は末端の一部が水酸基及び水酸基から誘導される官能基（例えばカルボキシニル基、スルホニル基等）で置換されていてもよく、ステレン（メタ）アクリル酸（エステル）、無水マレイン酸等と共重合体を形成していてもよい。

[0125] 本発明において好ましく用いられる低融点

た高熔点ワックスと同様のものを使用できる。

【0133】(4) 低融点置換アルキル系ワックスと高融点置換アルキル系ワックスの組合せ：低融点置換アルキル系ワックスは、上記(3)で示した低融点アルキル系ワックスと同様のものを使用できる。

【0134】高融点置換アルギル系ワックスは、前記(2)で示した高融点置換アルギル系ワックスと同様のものを使用できる。

【0.1.3.5】本発明のノードにおいて、所定のレオロジー特性性を効率良く実現するためには、結着樹脂及びワックスとの選択と組合が重要であり、更に結着樹脂とワックスとの適切な配合が重要である。すなわち、結着樹脂及びワックスが適切に選択されたとしても、これらの配合が不適切な方法となされた場合には、本来の良好な特性性を発現することができないからである。

【0136】本発明のトナーにおいて好ましく用いられる着剤樹脂とワックスの混合方法を以下に説明する。

【0137】本発明のトナーにおいて、その粘弾性的な特徴を再現させるためには、低弾性単結着剤樹脂成分と高弾性単結着剤樹脂成分と高融点ワックス成分と低融点ワックス成分とを併せて用いることであり、種々の方法により混合される。

[illegible]

発成固める方法が挙げられる。さらに、有機溶剤を用い、まず樹脂成分と有機溶剤を混合し、次に樹脂成分を溶剤に溶解し、最後に樹脂成分を溶剤から析出させる方法が挙げられる。この方法では、樹脂成分を溶剤に溶解させる際に、樹脂成分の分子量や官能基の種類によって、溶剤の種類や濃度を調整する必要がある。また、樹脂成分を溶剤から析出させる際に、析出速度や析出物の形状を制御するために、析出条件を調整する必要がある。これらの方法では、樹脂成分の分子量や官能基の種類によって、最適な方法を選択する必要がある。

る。他のワックスの添加方法としては、低融点ワックス成分のみを接着樹脂にあらかじめ添加する方法である。具体的には接着樹脂のみに高融点を有するワックス成分を添加する方法、接着樹脂と低融点ワックス成分を混合して低融点ワックス成分を含有する接着剤を用意する方法である。この場合には、高融点ワックス成分は低融点ワックス成分の合成工程で低融点ワックス成分を添加し、低融点ワックス成分を含有する接着樹脂、重合剤（触媒）とへンツェルミルキヤードに配合混合して攪拌融合したのちに接着剤を塗布することにより一体化して得られる。

【0139】本発明の静電荷像現像用トナーは、その帯電性をさらに安定化させる為に必要に応じて荷電制御剤

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を用いても良い。荷電制御剤は、結着樹脂100重量部  
当り0.1~10重量部、好ましくは0.1~5重量部  
使用するのが好ましい。

【0140】荷電制御剤としては、以下のものが挙げられる。

[10141] 例えは有機金属錯体、キレート化合物。有機金属錯体が挙げられる。具体的には、モノアミン錯体；芳香族ヒドロキシカルボン酸、芳香族ジカルボン酸化合物の金属錯体又は金属塩が挙げられる。他には、芳香族イソキノリン型錯体、芳香族モノ及びポリカルボン酸及びその無水物、そのエステル類；ビスフェノール型の樹脂類が挙げられる。

[10142] 本発明のトナーを磁性トナーとして用いる場合、磁性トナーに含ませる磁性材料としては、マグネタイト、マグヘマイト、フェライトの如き酸化物、及びその他の金属酸化物を含む酸化物、 $\text{Fe}$ 、 $\text{Co}$ 、 $\text{Ni}$ のような金属、あるいは、これらの金属と $\text{Al}$ 、 $\text{Co}$ 、 $\text{Cu}$ 、 $\text{Pb}$ 、 $\text{Mg}$ 、 $\text{Ni}$ 、 $\text{Sn}$ 、 $\text{Zn}$ 、 $\text{Sb}$ 、 $\text{Be}$ 、 $\text{Bi}$ 、 $\text{C}$ 、 $\text{Ca}$ 、 $\text{Mn}$ 、 $\text{Se}$ 、 $\text{Ti}$ 、 $\text{V}$ のような金属との合金、およびこれらの混合物が挙げられる。

【0143】 具体的には、磁性材料としては、四三酸化鉄 ( $\text{Fe}_3\text{O}_4$ )、二三酸化鉄 ( $\gamma\text{-Fe}_2\text{O}_3$ )、酸化鉄亜鉛 ( $\text{ZnFe}_2\text{O}_4$ )、酸化鉄イリウム ( $\text{Y}_3\text{Fe}_5\text{O}_{12}$ )、酸化鉄コバルト ( $\text{CoFe}_2\text{O}_4$ )、酸化鉄ガドリウム ( $\text{Gd}_3\text{Fe}_5\text{-O}_{12}$ )、酸化鉄 ( $\text{CuFe}_2\text{O}_4$ )、酸化鉄鉛 ( $\text{PbFe}_{12}\text{-O}_{19}$ )、酸化鉄ニッケル ( $\text{NiFe}_2\text{O}_4$ )、酸化鉄ネオジム ( $\text{NdFe}_2\text{O}_3$ )、酸化鉄マグネシウム ( $\text{BaFe}_{12}\text{O}_{19}$ )、酸化鉄マグネシウム ( $\text{MgFe}_2\text{O}_4$ )、酸化鉄マンガン ( $\text{MnFe}_2\text{O}_4$ )、酸化鉄ランタン ( $\text{LaFeO}_3$ )、鉄粉 ( $\text{Fe}$ )、コバルト粉 ( $\text{Co}$ )、ニッケル粉 ( $\text{Ni}$ ) が挙げられる。上述した磁性材料を単独で或いは2種以上の組合せて使用する。特に好適な磁性材料は、四三酸化鉄又は  $\gamma$ -二三酸化鉄の微粉末であ

【0144】これらの強磁性体は平均粒径が0.1~2  $\mu\text{m}$  (より好ましくは0.1~0.5  $\mu\text{m}$ ) で、10K エルステッド印加での磁気特性が抗磁力20~150エ ルステッド、飽和磁化50~200 emu/g (好ま しくは50~100 emu/g)、残留磁化2~20 em u/g のものが好ましい。

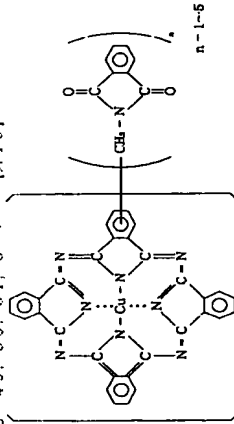
【0145】結着樹脂100重量部に対して、磁性体10～200重量部、好ましくは20～150重量部使用するのが良い。

【0146】磁性体の他に、着色剤としては、カーボンブラック、チタンホワイトやその他の顔料及び/又は染料を用いることができる。例えば本発明のトナーを磁性カートナーとして使用する場合には、染料としては、C. I. ダイイレクトレッド1、C. I. ダイイレクトレッド4、C. I. アッシュレッド1、C. I. ページック

—

レッド1、C. I. モーダントレッド30、C. I. ダ  
イレクトブルー1、C. I. ダイレクトブルー2、C.  
I. アジッドブルー9、C. I. アジッドブルー15、  
C. I. ベーシックブルー3、C. I. ベーシックブル  
ー5、C. I. モーダントブルー7、C. I. ダイレク  
トグリーン6、C. I. ベーシックグリーン4、C.  
I. ベーシックグリーン6がある。原料としては、ミネ  
ラルアスファルト、ネーブルイエロー、ナフトール  
イエローS、ハンザイエローG、バーマネントイエロー  
NCG、タートラジンブルー、キリヂンオレンジ、ベン  
ーマネントオレンジGTR、ピラゾロンオレンジ、ベン  
ジジンオレンジG、カドミウムレッド、バーマネントレ  
ッド4R、クオツチングレッドカドミウム塩、エオジン  
ブルー、プリリアントカーミン3B、マンガン紫、フア  
ストバイオレットB、メチルバイオレットレーキ、コバ  
ルトブルー、アルカリブルーレーキ、ピクトリアブル  
レーキ、フタロンニンブル、ファーストスカイブル  
ー、インダストリアルブルーBC、ビグメントグリー  
ンB、マラカイトグリーンレーキ、フアイナルイエロー  
グリーンGがある。

[0147] 本発明のトナーを二成分系現像剤又は一  
成分系現像剤利用の非磁性フルカラートナーとして使用す  
る場合には、着色剤として、次の様なものが挙げられ  
る。マゼンタ用着色剤としては、C. I. ビグメント  
レッド1、2、3、4、5、6、7、8、9、10、1  
1、12、13、14、15、16、17、18、1  
9、21、22、23、30、31、32、37、3  
8、39、40、41、48、49、50、51、5 \*  
[外16]



[0151] イエロー用着色剤としては、C. I. ビ  
グメントイエロー1、2、3、4、5、6、7、10、  
11、12、13、14、15、16、17、23、6  
5、73、83、C. I. パットイエロー1、3、20  
が挙げられる。

[0152] 非磁性カラートナーにおいて、着色剤の使  
用量は精製樹脂100重量部に対して、0.1~60重  
量部好ましくは0.5~50重量部である。

[0153] 本発明のトナーに流動性向上剤を添加（特  
に外添）しても良い。流動性向上剤は、トナーに添加す  
ることにより、流動性が添加前後を比較すると増加し得  
るものである。例えば、フッヒビニリデン微粉末、ポリ

[0155]  
 $\text{SiCl}_2 + 2\text{H}_2 + \text{O}_2 \rightarrow \text{SiO}_2 + 4\text{HCl}$   
[0156] この製造工程において、塩化アルミニウム  
又は塩化チタンの他の金属ハロゲン化合物をケイ素ハロ  
ゲン化合物と共に用いることによってシリカと他の金属  
酸化物の複合微粉末を得ることも可能であり、シリカと  
してはそれらも包含する。その程度は、平均的一次粒径 \*  
[0158]

AEROSIL (日本アエロジル社)

130

200

300

380

TT600

MOX170

MOX80

COK84

M-5

MS-7

MS-75

HS-5

EH-5

V15

N20E

T30

T40

Wacker HDK N 20  
(WACKER-CHEMIE GMBH社)

D-C Fine Silica (ダクコーニングCo. 社)  
Fransol (Fransil社)

[0159] さらには、該ケイ素ハロゲン化合物の気相  
酸化により生成されたシリカ微粉末に疎水化処理した処  
理シリカ微粉末がより好ましい。該処理シリカ微粉末に  
おいて、メタノール測定試験によって測定された疎水化  
度が30~80の範囲の値を示すようにシリカ微粉末を  
処理したものが特に好ましい。

[0160] 疎水化方法としては、シリカ微粉末と反応  
あるいは物理吸着する有機ケイ素化合物等で化学的に処  
理することによって付与される。好ましい方法として  
は、ケイ素ハロゲン化合物の蒸気相酸化により生成され  
たシリカ微粉末を有機ケイ素化合物で処理する。

[0161] 有機ケイ素化合物としては、ヘキサメチル  
ジシラン、トリメチルシラン、トリメチルクロロシラ  
ン、トリメチルエトキシシラン、ジメチルジクロロシラ  
ン、メチルトリクロロシラン、アリルジメチルクロロシ  
ラン、アリルフェニルジクロロシラン、ベンジルジメチ  
ルクロロシラン、プロムジメチルクロロシラン、  
α-クロルエチレントリクロロシラン、β-クロルエチ  
ルトリクロロシラン、クロルメチルジメチルクロロシラ

ン、トリオルガノシリルメルカプタン、トリメチルシリ  
ルメルカプタン、トリオルガノシリルアクリレート、ピ  
ニルジメチルアセトキシシラン、ジメチルエトキシシ  
ラン、ジメチルジメトキシシラン、ジフェニルジエトキシ  
シラン、ヘキサメチルジシロキサン、1,3-ジフェニル  
テトラメチルジシロキサン、1,3-ジフェニルテトラ  
メチルジシロキサンおよび1分子当たり2から12個のシ  
ロキサン単位を有し末端に位置する単位にそれぞれ1個  
宛のSiに結合した水酸基を含有するジメチルポリシロ  
キサン等がある。さらに、ジメチルシリコーンオイルの  
如きシリコーンオイルが挙げられる。これらは1種ある  
いは2種以上の混合物で用いられる。

[0162] 流動性向上剤として、前述した乾式注シリ  
カを、次に挙げるアミノ基を有するカップリング剤或い  
は、アミノ基を有するシリコーンオイルで処理した正荷  
電性疎水性シリカを使用しても良い。

[0163]

[外17]







- [0243] 得られた重合体 3, Mw = 103000, Mn = 9700, Mw/Mn = 10.6, Tg = 56. 3°Cであった。
- [0244] (製造例15) 製造例8において、第1段の重合反応終了時点で反応溶媒であるトルエンを可能な限り加熱することなく仮に留去することにより、分体内に重合開始剤に由来する過酸化物を有する中間体(1)を得た。
- [0245] この中間体(1)を固形分に換算して30重量部となる量と、スチレンモノマー50重量部、アクリル酸ブチルモノマー20重量部及びブチルモノマー2-エチルヘキサエート0.2重量部からなるモノマー組成物を調製した。遊星釜、撹拌機、温度計及び真空導入管を備えた反応容器に投入された0.1重量%のポリビニルアルコール、1重量%を含む脱臭した脱イオン水250重量部に、上記モノマー組成物を投入して懸濁液を調製した。反応容器を73°Cまで加熱してその温度で5時間反応を行なった。次に反応容器を95°Cまで昇温して更に2時間反応して重合反応を終了した。得られた懸濁液を蒸留し、水洗し、乾燥して重合体(15)を得た。
- [0246] 得られた重合体(15)は、Mw = 181000, Mn = 14500, Mw/Mn = 12.5, Tg = 58.4°Cであった。
- [0247] (製造例16) 製造例15において、中間体(1)を溶解するモノマー組成物のモノマーをスチレンモノマー50重量部、アクリル酸ブチルモノマー20重量部、ジニルベンゼンモノマー0.01重量部とした以外は同様にして、重合体(16)を得た。
- [0248] 得られた重合体(16)は、Mw = 238000, Mn = 119000, Mw/Mn = 20.0, Tg = 58.1°Cであった。
- [0249] (製造例17) 製造例11において、重合反応を行う前にキシレン200重量部に融点69.3°Cの炭化水素ワックスを14重量部添加した以外は同様にして重合反応を行うことにより、炭化水素ワックスを含む重合体(17)を得た。
- [0250] 得られた重合体(17)は、Mw = 231000, Mn = 7900, Mw/Mn = 2.9, Tg = 60.3°Cであった。
- [0251] (製造例18) 製造例11に於て、重合反応を行う前にキシレン200重量部に融点135°Cのポリプロピレンワックスを9重量部添加した以外は同様にして重合反応を行うことにより、炭化水素ワックスを含む重合体(18)を得た。
- [0252] 得られた重合体(18)は、Mw = 482000, Mn = 173000, Mw/Mn = 2.8, Tg = 61.3°Cであった。
- [0253] (製造例19) 製造例1において、ラジカル重合開始剤量を5重量部とした以外は同様にして重合反応を行うことにより、重合体(19)を得た。
- [0254] 得られた重合体(19)はMw = 11300, Mn = 4500, Mw/Mn = 2.5, Tg = 60.1°Cであった。
- [0255] (比較製造例1) 精製したキシレン200重量部、遊星釜、撹拌機、温度計、真空導入管及び真空下装置を備えた反応容器に投入した後に空気を通気しながら110°Cまで加熱し、スチレンモノマー78重量部、アクリル酸ブチルモノマー22重量部、ラジカル重合開始剤として例示化合物(2-5)2.3重量部及びキシレン100重量部からなるモノマー組成物を2時間かけて滴下し、その温度で8時間保持して重合反応を終了することによって重合体(20)を得た。
- [0256] 得られた重合体(20)は、Mw = 13200, Mn = 5700, Mw/Mn = 2.3, Tg = 60.4°Cであった。
- [0257] 得られた重合体(20)の<sup>1</sup>H-NMRスペクトルを測定したところ図8に示すような結果を得た。
- [0258] (比較製造例2) スチレンモノマー78重量部、アクリル酸ブチルモノマー22重量部及びラジカル重合開始剤として例示化合物(2-5)0.15重量部からなるモノマー組成物を、0.1重量%のポリビニルアルコールを含む脱臭した脱イオン水250重量部を有したオートクレープに投入し、90°Cで8時間重合反応を行ない、次に110°Cまで加熱して3時間反応を行なって重合体(21)を得た。
- [0259] 得られた重合体(21)は、Mw = 426000, Mn = 164000, Mw/Mn = 2.6であり、Tg = 60.9°Cであった。
- [0260] (比較製造例3) ラジカル重合開始剤を過酸化ベンゾイル3重量部とした以外は比較製造例1と同様にして比較用重合体(22)を得た。
- [0261] 得られた重合体(22)は、Mw = 121000, Mn = 5900, Mw/Mn = 2.1, Tg = 60.1°Cであった。
- [0262] (比較製造例4) 製造例15で用いた中間体(1)に代えて重合体(20)30重量部を使用し、た以外は製造例15と同様にして重合体(23)を得た。
- [0263] 得られた重合体(23)は、Mw = 179000, Mn = 7900, Mw/Mn = 22.7, Tg = 58.2°Cであった。
- [0264] (実施例1) 重合体(1) 70重量部

- [0265] 上記の樹脂混合物を有機溶剤に溶解し均一な溶液状態とし、減圧下有機溶剤を留去して結着樹脂組成物(A)を得た。
- [0266] 得られた結着樹脂組成物(A)は、ガラス\* (a) 結着樹脂組成物(A) 100重量部 (b) 磁性体：(平均粒径0.2μm) 90重量部 (c) モノノ金属錯体：(負荷電性制御剤) 2重量部 (d) ワックス：ポリプロピレンワックス(エチレンを約5重量%共重合したワックス；融点135°C, Mw = 8500, Mn = 1100) 4重量部
- [0268] 上記材料をベンゾエチルキサンで前混合した後、130°Cで二軸混練機出機によって溶融混練を行った。混練物を冷却後、ガンターミルで粗粉砕した後、ジェット気流を用いた微粉砕機を用いて粉砕し、更に風力分級機を用いて分級し、重量平均粒径6.4μmの負荷電性絶縁性磁性トナー粒子(磁性トナー)を得た。この磁性トナー粒子100重量部に、負荷電性絶縁性シリカ(BET比表面積300m<sup>2</sup>/g) 1.0重量部をベンゾエチルキサンにて外部添加して磁性トナー(1)とした。
- [0269] 得られたトナーは、トナーのTHF可溶分のGPCによる分子量分布において、分子量18200にメインピークを及び分子量143000にサブピークを有していた。
- [0270] この磁性トナーのレオロジー特性を測定するためにトナーを加熱、溶融し、直径約8mm、高さ3mmの円柱状試料を製し、常法に従って直径7.9mmのセレンイタイプ標準のガラスプレート上に固定し、貯電特性及び損失率の温度依存性を測定した。磁性体の温度依存性の測定結果を図1に示す。
- [0271] ワックスの分散性を評価するために上記磁性トナーを光学顕微鏡に陽光板をとりつけて低倍率(約30倍)で視野中の約500個のトナー粒子を観察したところ、遊離したワックスの存在を示す斑点は視野に9~10点みられるだけであり良好であった。
- [0272] この磁性トナーを図5に示すデジタル複写機(キヤノン製GP-215)に用いて10万枚の通紙面出し耐久を行なった。
- [0273] デジタル複写機においては、直径30mmのアルミニウム製シリンダー上にOPC感光層を有する感光ドラムに、一次帯電器で700Vに帯電し、レーザ光によってイメージキャキャニングによりデジタル画像を形成し、4極の磁板(現象磁板は950ガウス)を有する固定磁石を内包している現象スリープにより磁板に着せられた負荷電性絶縁性磁性トナーで反転現像した。
- [0274] 現象スリープには、直流バイアス-600V及び交流バイアス<sub>pp</sub>800V(1800Hz)を印加した。感光ドラム上の磁性トナー像を転写手段によって普通紙に静電転写し、普通紙を除電して後に普通紙を感光ドラムから分離し、普通紙上の磁性トナー像を加熱ローラー及び加圧ローラーを有する加熱加圧手段で定着
- [0275] 画像濃度は耐久印刷(1~10枚目)で1.4、10枚耐久終了時点で1.43とほとんど変化せず、ライン画像の飛散、太りの加減も変化しにくく良好であった。10万枚耐久終了時点でOPC感光ドラム上を詳細に観察したところ、遊離したワックスの付着もみられずOPC感光ドラム表面にも目立つ損傷はみられなかった。画像上にはOPC感光ドラム表面の損傷に起因すると推定される画像欠陥はなかった。
- [0276] 次にデジタル複写機の定着器をとりはずし、外部駆動装置をとりつけ150mm/秒で定着ローラーを回転させ、温度制御装置をとりつけて、100~250°Cの範囲で定着ローラーの温度を変えられた様に改造した。定着器は温度3~5°Cに制御された恒温槽内で実験し、定着ローラーが槽内温度と一致したのを確認後に電源を投入し、上部ローラー(加熱ローラー)が130°Cに達した直後に60g/m<sup>2</sup>の転写紙を用いて定着テストを行なった。次に転写紙を50g/m<sup>2</sup>、80g/m<sup>2</sup>及び120g/m<sup>2</sup>と順次変えて定着テストを実施した。
- [0277] 以上の様な定着テストの結果、60g/m<sup>2</sup>で融点低率17%であり、50g/m<sup>2</sup>、80g/m<sup>2</sup>及び120g/m<sup>2</sup>の各転写紙を用いた場合の融点低下率は、9%、21%及び24%と実用上問題ないレベルであった。50°Cに温度制御された恒温槽内に20日間放置して前プロベキング試験を行なったところ、流動性の変化はみられず良好であった。
- [0278] (実施例2) ワックスを融点69°Cの炭化水素ワックス2重量部と実施例1で用いた融点135°Cのポリプロピレンワックス3重量部とを溶解混合して調製した融点ワックスと高融点ワックスの均一混合物を使用した以外は、実施例1と同様にして磁性トナー(2)を得た。トナーの物性及び評価結果を表1及び2に示す。
- [0279] (実施例3) 結着樹脂組成物(A)に代えて、重合体(1)70重量部と重合体(13)30重量部とを有機溶剤に溶解して均一に混合した後に有機溶剤を留去して調製した結着樹脂組成物(B)を用いた以外は、実施例1と同様にして磁性トナー(3)を得た。トナーの物性及び評価結果を表1及び2に示す。
- [0280] (実施例4) ワックスを実施例2で用いた





【表1】

表1

	結晶性樹脂組成物又は重合体	トナーのTHER特性の平均値による分子分布				
		ガラス転移温度 (T <sub>g</sub> : °C)	数均分子量 (M <sub>n</sub> )	ピーク位置		
				メインピーク	サブピーク	
実施例1	結晶性樹脂組成物 (A)	61.6	12200	149000	18200	413000
実施例2	結晶性樹脂組成物 (A)	61.5	12100	147000	18100	413000
実施例3	結晶性樹脂組成物 (B)	59.7	12300	116000	18300	368000
実施例4	結晶性樹脂組成物 (B)	59.3	12400	118000	18500	366000
実施例5	結晶性樹脂組成物 (C)	60.1	13500	133000	20300	406000
実施例6	結晶性樹脂組成物 (D)	57.9	15400	136000	22700	412000
実施例7	結晶性樹脂組成物 (E)	55.5	14300	142000	21300	434000
実施例8	結晶性樹脂組成物 (F)	60.3	11500	146000	17400	449000
実施例9	結晶性樹脂組成物 (G)	59.9	11900	141000	17700	432000
実施例10	結晶性樹脂組成物 (H)	58.6	13900	143000	20800	426000
実施例11	結晶性樹脂組成物 (I)	58.3	14100	146000	21100	439000
実施例12	結晶性樹脂組成物 (J)	59.7	7100	123000	10300	429000
比較例1	結晶性樹脂組成物 (K)	60.8	5500	158000	11800	449000
比較例2	重合体 (23)	58.2	7900	179000	16800	-
比較例3	結晶性樹脂組成物 (L)	60.7	7400	122000	12300	394000
比較例4	結晶性樹脂組成物 (N)	60.8	8100	125000	11900	384000

(34)

【図2】本発明のトナーが適用し得る画像形成装置の一例を示す説明図である。

【図3】図2に示す画像形成装置の現像部の拡大図を示す。

【図4】比較用トナーのレオロジー特性を示すグラフである。

【図5】本発明の画像形成方法を実施し得る画像形成装置の他の例を示す説明図である。

【図6】本発明の画像形成方法を用いた画像形成装置をファクシミリ装置のプリンターに適用する場合のプロット図を示す。

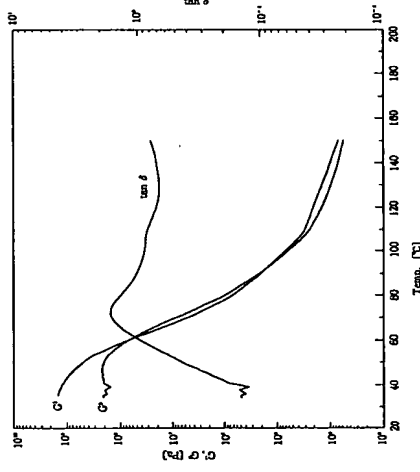
【図7】製造例1で製造した重合体(1)のH-NMRスペクトルのチャートを示す図である。

【図8】比較製造例1で製造した重合体(20)のH-NMRスペクトルのチャートを示す図である。

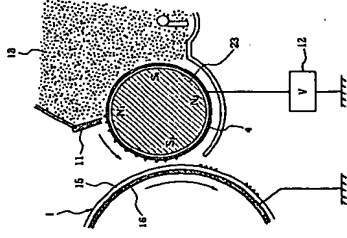
【符号の説明】

- 1 静電荷保持体
- 2 一次帯電器
- 3 転写帯電器
- 4 現像スリーブ
- 5 露光
- 6 イレース露光
- 7 加熱加圧ローラー定着器
- 8 クリーニングブレード
- 9 現像器
- 10 10.1 感光ドラム
- 10.3 現像剤容器
- 10.4 一成分系現像剤
- 10.5 多成分系現像剤
- 10.8 現像スリーブ
- 10.9 バイアス印加電圧
- 11.1 弾性規制ブレード
- 11.3 接触(ローラー)転写手段
- 11.4 電圧印加手段
- 11.5 露光
- 20 11.6 イレース露光
- 11.8 加熱加圧ローラー定着器
- 11.8a クリーニングブレード
- 11.9 接触(ローラー)帯電手段
- 12.0 現像手段
- P 被記録材

【図1】



【図3】



【0322】

ものである。

【発明の効果】本発明の静電荷保持用トナーは、転写

【図面の簡単な説明】

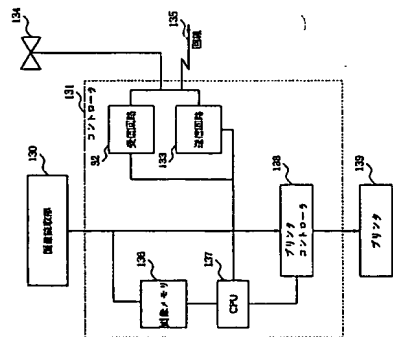
紙の厚みが厚い紙であっても低温度帯性、荷オフセット

性、耐ブロッキング性及び多量収容耐久性等に優れている。

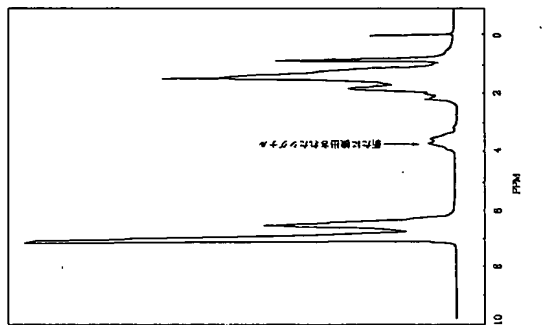
【図1】本発明のトナーのレオロジー特性を示すグラフ

50 である。

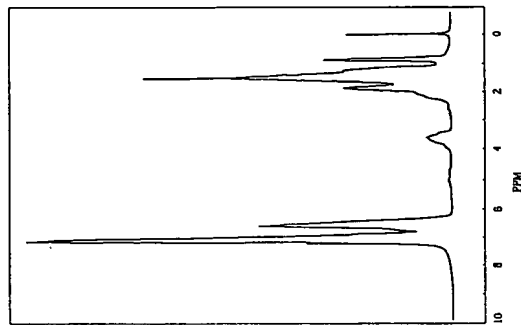
【図6】



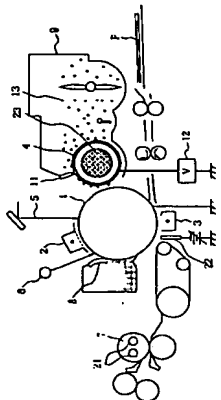
【図7】



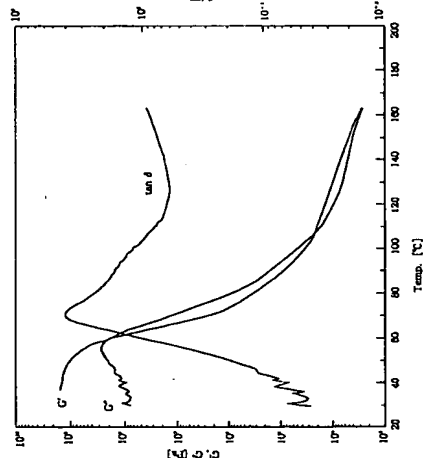
【図8】



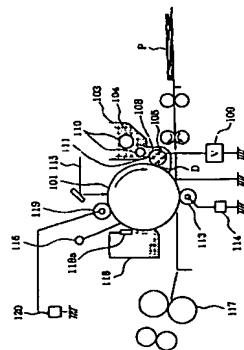
【図2】



【図4】



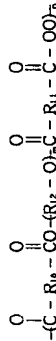
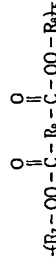
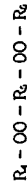
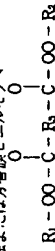
【図5】





を経て合成された共重合体を含有していることを特徴とする請求項1乃至1.3のいずれかに記載の静電荷像現像用トナー。

【請求項1.6】 結着樹脂は、(1) (メタ) アクリル酸エステルモノマー単位または芳香族ビニルモノマー



(1)

(2)

(3)

(4)

(式中、 $\text{R}_1$ 、 $\text{R}_2$ 、 $\text{R}_3$ 、 $\text{R}_4$ 、 $\text{R}_5$ 、 $\text{R}_6$ 、 $\text{R}_7$ 、 $\text{R}_8$ 、 $\text{R}_9$ 、 $\text{R}_{10}$ 、 $\text{R}_{11}$ 及び $\text{R}_{12}$ は、炭素数2～30の直鎖、分岐または環状のアルキル基または炭素数6～20のアリール基を示し、これらは同じであっても相互に異なってもよい。k、nは2～50の整数を被わし、mは1～20の整数を被わす。) で表わされるラジカル重合開始剤を含むモノマー組成物を50～120℃で重合反応する工程。

(i) 芳香族ビニルモノマー単位または芳香族ビニルモノマーと (メタ) アクリル酸エステルモノマーを重量比で2:0.1～1:1で混合したモノマー混合物を再度添加して温度55℃以上で重合反応する工程；からなる少なくとも2段階の異なる温度で重合反応する工程を経て合成された共重合体を含有していることを特徴とする請求項1乃至1.3のいずれかに記載の静電荷像現像用トナー。

【請求項1.7】 結着樹脂は、2.500～50.000の数平均分子量 (Mn) 及び10.000～1.500.000の重量平均分子量 (Mw) を有していることを特徴とする請求項1乃至1.6のいずれかに記載の静電荷像現像用トナー。

【請求項1.8】 該トナーは、該トナーのT/HF可溶分GPGCによる分子重量分布において、分子量12.000～40.000の領域及び分子量50.000～1.200.000の領域にそれぞれピークを有していることを特徴とする請求項1乃至1.7のいずれかに記載の静電荷像現像用トナー。

【請求項1.9】 該トナーは、該トナーのT/HF可溶分GPGCによる分子重量分布において、分子量45.000以下の低分子重量領域の面積 (L) と分子量45.000を超える高分子重量領域の面積 (H) との比が下記関係 (L) : (H) = 1 : 9～9.5 : 0.5

を満足することを特徴とする請求項1乃至1.8のいずれかに記載の静電荷像現像用トナー。

と (メタ) アクリル酸エステルモノマーを重量比で1:2.0～1:1で混合したモノマー混合物と、下記化学式 (1)、(2)、(3)、又は (4)

[外3]

(1)

(2)

(3)

(4)

【請求項2.0】 静電荷像保持体に保持されている静電増倍用トナーにより現像し、トナー画像を形成する現像工程。

該トナー画像を記録材に転写する転写工程及び該記録材に転写されたトナー画像を加熱定着手段により該記録材に加熱定着する定着工程、を有する画像形成方法において、

該トナーは、結着樹脂、着色剤及びワックスを含有しており、

該トナーは、

(a) 損失弾性率と貯蔵弾性率の比 ( $G'/G'$ ) が  $\tan \delta$  が1.0となる温度が55～70℃の温度領域に存在し、かつ、そのときの弾性率が  $1.5 \times 10^8$  Pa以下であり、

(b) 温度40℃における貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が1.8～4.0であり、

(c) 貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が3～20であり、

(d) 温度70℃における貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が1.00℃における貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が50～250であり、

(e) 温度110℃における貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が1.40℃における貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2～20であることを特徴とする画像形成方法。

【請求項2.1】 該トナーは、比 ( $G'/G'$ ) が1.0となる温度が58～68℃の温度領域に存在し、そのときの弾性率が  $1 \times 10^7$  Pa～ $1.3 \times 10^8$  Paであることを特徴とする請求項2.0に記載の画像形成方法。

【請求項2.2】 該トナーは、比 ( $G'/G'$ ) が1.0となる温度が59～65℃の温度領域に存在し、その

ときの弾性率が  $3 \times 10^7$  Pa～ $1.0 \times 10^8$  Paであることを特徴とする請求項2.0に記載の画像形成方法。

【請求項2.3】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.0～3.5であることを特徴とする請求項2.0乃至2.2のいずれかに記載の画像形成方法。

【請求項2.4】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が4～1.5であることを特徴とする請求項2.0乃至2.3のいずれかに記載の画像形成方法。

【請求項2.5】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が50～100であることを特徴とする請求項2.0乃至2.3のいずれかに記載の画像形成方法。

【請求項2.6】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が60～240であることを特徴とする請求項2.0乃至2.5のいずれかに記載の画像形成方法。

【請求項2.7】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が70～200であることを特徴とする請求項2.0乃至2.5のいずれかに記載の画像形成方法。

【請求項2.8】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.9】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が1.40℃における貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.10】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.11】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.12】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.13】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.14】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.15】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.16】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.17】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.18】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.19】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.20】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.21】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.22】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.23】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.24】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.25】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.26】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.27】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.28】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.29】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.30】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.31】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.32】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.33】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.34】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.35】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.36】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.37】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

【請求項2.38】 該トナーは、貯蔵弾性率 ( $G'$ ) の比 ( $G'/G'$ ) が2.5～1.8であることを特徴とする請求項2.0乃至2.7のいずれかに記載の画像形成方法。

